EXPERIMENTS AND Considerations ABOUT THE Porosity of Bodies, IN TWO ESSAYS.

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LONDON,
Printed for *Sam. Smith* at the *Prince's Arms* in S. *Pauls* Church-Yard: 1684.

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2735:11

TO THE READER.

THe Reader is to be advertis'd, not to expect in the following Eſſay a Regular, or ſo much as a Coherent, Diſcourſe. For it was intended only as a collection of looſe Experiments and Obſervations about the Poroſity of the parts of Bodies belonging as Chymiſts ſpeak) to the Animal Kingdom, and laid (not to ſay thrown (together, in order to what I had thoughts of offering, towards an Intelligible account of Occult Qualities. I am not ignorant, that even one of the moſt ancient and famous of Phyſicians hath ſaid, that a mans body is

(almoſt) every where perſpirable. But I judg'd that a Doctrine of ſuch moment, and which diverſe things in the Theory and Practice of after Phyſicians may make one think they either disbelieved or diſregarded, did not deſerve to be ſlightly deliver'd, and in general terms, but to be more narrowly conſidered, and likewiſe made out by Particular Inſtances, whoſe applyableneſs and uſefulneſs to explain divers obſcure Phænomena, may hereafter appear much greater, then perchance at the firſt ſight they will be thought.

And the foregoing advertiſement, with a light change, which 'tis preſum'd the Reader may eaſily make of imſelf, is to be extended to the Eſſay tacked to this about the Pores of Solid Bodies, and ſo may excuſe the abſence of a diſtinct Preface to it.

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An Essay of the POROUSNESS OF ANIMAL BODIES.

AS the most numerous part of the Pores of Bodies is too minute to be seen, so the Contemplation of them has been thought too inconsiderable to be regarded. But when I consider, how much most of the Qualities of Bodies, and consequently their operations depend upon the structure of their minute, and singly invisible, particles, and that to this latent contexture, the bigness the figure and the collocation of the Intervals and Pores

do neceſſarily concur with the Size, Shape and Diſpoſition or contrivance of the ſubſtantial parts I cannot but think the Doctrine of the ſmall Pores of Bodies, of no ſmall importance to Natural Philoſophy. And I ſcarce doubt, but if ſuch little things had not eſcaped the ſight of our Illuſtrious *Verulam*, he would have afforded a good Porology (if I may ſo call it) a place, (and perhaps not the loweſt neither,) among his *Deſiderata*.

And, *though* other imployments and avocations hinder me from attempting to treat of this ſubject as amply and particularly as it deſerveth, or even as I had deſign'd in a Scheme drawn diverſe years ſince, and ſeen by ſome *Virtuoſi*; *Yet*, not to leave apart of Phyſicks, that ſeems to me ſo curious and important, altogether as uncultivated as I found it; I ſhall preſent you as many of the Notes I had drawn together about this ſubject, as I can conveniently (for I do not pretend to do it methodically) reduced to three heads: Whereof the firſt, which

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will challenge to it ſelf this preſent eſſay, is the *porosity of Animal Bodies*, about which I ſhall not be ſolicitous to marſhal my obſervations, ſince they all conſpire to ſhew but this one thing; That the parts of Animals, eſpecially whileſt theſe are alive, are furniſhed with numerous Pores.

Thoſe parts of the Bodies of Animals, wherein their poroſity may be beſt ſhewn ſeem to be their Membranes or Skins, the Bones, the Fleſh, and Coagmentations of Membranes, Fleſh and Juices. And therefore it would be proper enough to treat of theſe Heads diſtinctly, and give Inſtances of each of them in particular. But yet I think it will be more convenient, to ſet down in order the principal Fountains, whence the Porouſneſs of the ſubſtances belonging to the Animal Kingdom (as the Chymiſts ſpeak) may be derived, and to annex to each of theſe the Experiments and obſervations, upon which I argue from it, and which it will be eaſy to refer, if

that be thought fit, to this or that of the parts above mentioned (namely the Membranes, Bones, &c.) whereto they shall (respectively) appear the most properly to belong.

CHAP. I.

THe first thing from which I will deduce the Porosity we have been speaking of, is, the Frame or Constitution of the stable Parts of the Bodies of Animals. For the Body of an Animal being not a rude and indigested lump of matter, but a curious engine, admirably framed and contrived for the exercise of several Functions as Nutrition, Generation, Sensation, and many differing local Motions, it was necessary that it should be furnished with variety of Dissimilar and Organical parts not only very Skilfully, but very differingly, contrived congruous to the several uses for which they were designed, or if you please, to the several Functions they were

were to perform. And, becauſe 'twill be eaſily granted, that the Corpuſcles, that are skilfully brought together for ſuch purpoſes, muſt be ſo contexed as not to touch one another exactly every where, it will readily follow that they muſt leave little Intervals or Pores between them, and that, conſidering the multitude of particles that muſt go to the making up the Body of the Animal, and the great difference and variety in point of bigneſs and figure of the Corpuſcles that are requiſite to contex ſuch differing parts, as Membranes, Fibres Bones, Grizles, Ligaments, Veins, Arterys, Nerves, *&c.* Both the number and the variety of the Pores cannot but be very great. This argument will be much confirmed, by what there will be occaſion to ſay further to the ſame purpoſe, in the Eſſay touching the Poroſity of even Solid Bodies. Wherefore I ſhall now proceed to the Second thing, whence we may derive that of Animal Subſtances.

CHAP.

CHAP. II.

THis is afforded us by conſidering the Nutrition of Animals. For there being continually a great waſte made of their ſubſtance, partly by the excluſion of viſible excrements, and partly by the avolation of inviſibles ſteam, this great loſs muſt neceſſarily from time to time be repairpaired by the ſupplies afforded by Nutrition of which the beſt, if not the only Intelligible, way of giving an account, is, to conceive that the alimental Juice, prepared chiefly in the Stomach is impelled or attracted (for to our preſent purpoſe it matters not which) to the parts of the Body that are to be nouriſhed by it, and the Corpuſcles of the juice inſinuate themſelves at thoſe Pores they find commenſurate to their Bigneſs, and Shape; and thoſe that are muſt congruous, being aſſimilated, add to the ſubſtance of the part wherein they

they ſettle, and ſo make amends for the Conſumption of thoſe that were loſt by that part before. This may be illuſtrated by what happens in Plants, and eſpecially Trees, in which, of the various Corpuſcles that are to be found in the liquors, that moiſten the Earth, and are agitated by the heat of the Sun and the Air, thoſe that happen to be commenſurate to the Pores of the Root, are by their Intervention impelled into it, or imbibed by it, and thence conveyed to the other parts of the Tree in the form of Sap which paſſing through new ſtrainers, (whereby its Corpuſcles are ſeparated, and prepared or fitted to be detained in ſeveral parts) receives the alterations requiſite to the being turned into Wood, Bark, Leaves, Bloſſoms, Fruit, *&c.* But to return to Animals, our argument from their Nutrition will be much confirmed, by conſidering, that in Children and in other young Animals, that have not yet attained their due Stature and Bulk, the Nutrition is ſo copious as to amount

to

to a continu'd Augmentation. For, as 'tis evident that Animals grow in all their parts, and each part according to all its Dimenſions, in ſo much that even the cavities of Bones increaſe; ſo we cannot well conceive how this can be done, unleſs the Nutritive liquor be diſtributed through the whole Body of the part that is to be nouriſhed and augmented. And to this diſtribution 'tis requiſite that the Body abound with Pores into which the congruous particles of the Juice may be intimatly admitted, & penetrating even into the innermoſt receſſes, may place or lodge themſelves in the manner that is moſt convenient for the Natural Increaſe of the part. But the more particular Declaration of this Proceſs I leave to Anatomiſts and Phyſicians.

CHAP. III.

HAving premis'd once for all, that in this Eſſay, I often uſe the word Skin in the lax and popular ſenſe of it, with-

without nicely diſtinguiſhing the *Epidermis* or *Cuticula*, called in Engliſh the *Scarf-skin*, from the *Cutis* it inveſts and ſticks cloſely to; I ſhall proceed to another Topic, whence the Porouſneſs of Animals may be argued, namely, the great plenty of matter that is daily carried off by Sweat, and inſenſible Tranſpiration. For, 'tis confeſt that Sweat is diſcharged at the Pores of the skin; and ſince there is no penetration of Dimenſions, we may ſafely conclude, that the matter that is not waſted by Sweat, or by any other ſenſible way of evacuation, muſt have ſmall Pores or out-lets in the Skin, at which it may iſſue in the form of ſteams; though nothing hinders but that inviſible *Effluvia* alſo may evaporate at the ſame Pores with the Sweat, though for want of plenty or groſſneſs, or a fit diſpoſition in the ambient, thoſe Effluvia be not at the Orifices of thoſe Pores brought into little Drops, ſuch as thoſe of ſweat.

That therefore the Skins of a multitude of Animals, though they ſeem

cloſe

cloſe to the eye, may be porous, may (as we have been ſaying) be argued in many of them from their ſweating. But becauſe all of them have not been obſerved to ſwear, as is wont to be particularly affirmed of Dogs, we ſhall add ſome other Inſtances to make it probable.

We may ſometimes, in the ſmooth skin of a living man, diſcern Pores with good Microſcopes, and, with one that is none of the beſt, we may eaſily on the inſide of gloves, which are made but of skins dreſt, diſcern good ſtore of theſe little out-lets: Sometimes orderly enough ranged to make the ſight not unpleaſant. And though ſome of them may, I think, be ſuſpected to have been made by the Hairs that grew on the skin before 'twas dreſt, yet that greater numbers of them, than can be ſuppoſed to come from thence, are perforations that paſs quite through the Leather, may, not improbably, be ſhewn by the uſual Practice of Chymiſts, to purify Quick-ſilver by tying it up ſtrictly

in

in a piece of kids or ſheeps Leather, and then wringing it hard to force it out; by which means the lower ſurface of the Leather will be covered with a Mercurial Dew or Sweat which will fall down and fly out, as the Pores happen to open this or that way, in a thick ſhower of globules, leaving the droſs behind in the Leather. And tho when a mans skin is tanned it is of a greater thickneſs then one would expect, and that which I employed ſeem'd almoſt as thick as a Buck-skin Glove yet having had the curioſity to try the ſame Experiment with the skin of a mans Arm, I found the Quick Silver would be ſqueez'd out at the Pores of that alſo. 'Tis not neceſſary that I ſhould here inquire, whether the little holes, unperceiv'd by the naked Eye, at which the Sweat is diſcharged, and perhaps the matter that the Body looſes by inſenſible tranſpiration gets out, be not, at leaſt moſt of them, the Orifices of ſmall excretory veſſels, belonging to thoſe very numerous glandules which the excellent Anatomiſts

mists *Steno and Malpighi* are said to have discovered beneath the *Cuticula*, and which for their smalness and shape have been called *Glandulæ miliares.* I need not, I say, engage in this inquiry, since according to this ingenious opinion also, the Skin must be allow'd a multitude of small Perforations or Pores, and that is sufficient for my purpose, from whencesoever this Porosity proceeds in a mans Skin. For the next observation will shew that some membranes of Animals may give passage to transpirable matter without being perforated by the excretory Vessels of Glandules.

The Membranes or Skins under the shells of Hens Eggs, though they be very thin, are of a Contexture very fine and close as may be confirmed by their resisting the sharp Corpuscles of Vinegar; and yet, that not only these Skins, but the shells that cover them, are porous, may be inferred from the Experiments I made, of keeping them suspended for a good while, and carefully counterpoised in good scales; for

for by theſe it appeared, that the Eggs did from time to time manifeſtly loſe in weight; which could not reaſonably be imputed but to an inviſible Tranſpiration, the rather, becauſe uſually in eggs that have been kept long, there will be at one end a cavity which is wont to increaſe with their age, and is made by the ſhrinking of the Membrane from the Shell, to accommodate it ſelf to the diminiſhed quantity of matter, that remains to be involved by it.

When I conſider the plenty of matter, that is wont to be diſcharged daily by inſenſible Perſpiration, eſpecially in Healthful men that exerciſe themſelves moderately, I cannot but think it probable, that the minute Pores, that ſuffice for the carrying off ſo much matter, are very numerous, and are much more ſo than even by the multitude of drops of ſweat, that ſerve to wet the skin, men are wont to imagine. For *Sanctorius* in his excellent little Tract *de Medicina ſtatica* affirms, that what is barely car-

ryed off by inſenſible tranſpiration does ordinarily amount to more, that is, diminiſhes more the weight of a mans Body, than all the viſible excrements (whether groſs or liquid) put together. *Aph. vi.* He adds, If the meat and Drink, taken in one day, amount to the weight of eight pound, the inſenſible Tranſpiration ordinarily amounts to five pounds or thereabouts. And elſewhere ſays, that ſometimes in the ſpace of 24 hours, in the Winter time, a healthy Body may exhale fifty ounces or more. And ſome Tryals, that I have carefully made upon my ſelf, added to ſome others of a very curious as well as great Prince, that made uſe of a like inſtrument, & did me the honour to acquaint me with the events, gave me no cauſe to reject *Sanctorius*'s obſervations, conſidering the difference in point of heat, between the climate of *Italy*, where he writ, and that of *England*, where ours were made; only I fear, there has been committed an overſight by thoſe many that aſcribe all the decrement of weight,

weight, that is not referrable to the groſſer Excrements, to what tranſpires at the Pores of the viſible parts of the skin, without taking notice of that great plenty of ſteams that is in expirations diſcharged through the Windpipe by the Lungs, and appear manifeſt to the Eye it ſelf in froſty weather; though they may be preſumed to be then leſs copious than thoſe Inviſible ones that are emitted in Summer, when the ambient Air is much warmer. But *though* I look upon the Windpipe as the great Chimney of the Body in compariſon of thoſe little Chimneys (if I may ſo call them) in the Skin, at which the matter that is waſted by perſpiration is emitted, *yet* the number of theſe little vents is ſo very great, that the fuliginous Exhalations that ſteal out at them, cannot but be very conſiderable. Beſides that, thoſe that are diſcharged at the *Aſpera Arteria*, do probably, at leaſt for the moſt part, iſſue out at the latent Pores of the Membranes that inveſt the Lungs; which membranes

may be lookt upon as external parts of the Body, in reference to the air, tho not in reference to our ſight. But, to return to our Eggs, we may ſafely allow a very great evacuation to be made at the Pores of the skin in man, who is a ſanguineous and hot Animal, ſince we ſee that even Eggs, that are ſtill actually cold, tranſpire. And I elſewhere mention the copious tranſpiration even of Frogs, that are always cold to the touch; and the Decrement in weight of ſome Animals, ſoon after they are ſtrangled or ſuffocated, when, their vital Heat being extinct, no more fumes are emitted by expirations at the wind-Pipe: To which ſigns may be added the trivial experiment of holding in warm weather the palp of ones Finger, as near as one can without contact, to ſome cold & ſolid ſmooth body, as to a piece of poliſhed Steel or Silver; for you will often times ſee this Body preſently ſullyed or overcaſt, with the inviſible ſteams that iſſue out of the Pores of the Finger, and are by the cold and ſmooth

ſurface

ſurface of the Body condenſed into viſible ſteams, that do as 'twere cloud that ſurface, but upon the Removal of the Finger, quickly fly off, and leave it bright again.

The Perviouſneſs of the skin outwards may not improbably be argued from the quickneſs wherewith ſome Medicines take away ſome black and blew Diſcolorations of the skin, that happen upon ſome lighter ſtroke, or other contuſions. For, ſince theſe preternatural and unſightly colours are wont by Phyſicians to be imputed to ſome ſmall portions of blood, that upon the contuſion is forced out of the capillary veſſels that lye beneath the ſurface of it, & being extravaſated are obliged to ſtagnate there; it ſeems very likely, that if a powerful Medicine do quickly remove the diſcoloration, that work is performed by attenuating, and diſſolving, and agitating the matter, and diſpoſing it to tranſpire through the cutaneous Pores, though perhaps, when 'tis thus changed, ſome part of it may be imbibed again by

the Capillary Vessels, and so by the circulation carryed into the mass of Blood. Now, that there are Medicines that will speedily work upon such black and blew marks, the Books and Practice of Physicians and Chirurgeons will oblige us to admit. *Helmont* talks much of the great vertue of white Briony root in such cases. And a notable Experiment made a while ago by a Learned acquaintance of mine in an odd case, did not give *Helmont* the Lye. And I know an eminent Person, who having some while since received a stroke, by a kick of an Horse, on his Leg, a very threatning contusion, which made the part look black and frightful, he was in a few hours cured of the pain of the hurt, and freed from the black part of the Discoloration by the bare application of the chopt leaves of Hissop mixt with fresh Butter into the form of a Pultess.

Nor is it only the Skin that covers the visible parts of the Body that we judg to be thus porous, but in the Membranes

branes that inveſt the internal parts, we may reaſonably ſuppoſe both numerous and very various Pores, according to the exigency of their peculiar and different Functions or Offices. For, the two firſt cauſes of Poroſity mention'd in this Eſſay, are as well applicable to the Membranes that cover the internal parts, as the Liver, the Spleen, *&c.* as to the external Skin, or Membrane that covers the Limbs; and in ſome reſpects the tranſpiration through ſuch Pores ſeems more advantaged, than that through the Pores of the ſurface of the Body; ſince the parts that environ the Spleen, Liver, Kidneys, *&c.* in man, are hot in compariſon of the ambient Air, and being alſo wet, which the Air is not, the laxity of the Pores of the internal parts is doubly befriended. And perhaps it may be allowable to conceive, both the Skin that covers the Limbs, and the Membranes that inveſt the internal parts of the Body, to be like worſted ſtockings, Waſt-Coats, *&c.* Which in their

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ordinary ſtate have a kind of continuity, but upon occaſion can have their Pores every way enlarged and ſtretched, in this or that manner, as the Agents that work on them determine them to be. This may be confirmed, by what we manifeſtly ſee in the finer ſort of leather, as that of Kid or Lamb, and by the latent Pores that may be opened in Sheeps-Leather, and mans Leather, by the preſſure of included Quick-Silver.

This Poroſity of a living mans Skin and other Membranes, though internal ones, will the more eaſily be aſſented to if it appear that ſuch thick and groſs Membranes, as the urinary bladders of dead Animals, are Porous and Penetrable even by Water. This we tryed, by putting ſome ſalt of Tartar in a clean well dryed bladder (which ought to be afterwards tyed up cloſe in the neck, leſt the effect ſhould be aſcribed to the moiſt Air) and leaving the lower part of the bladder, as far as the Salt, reached immerſed in common Water, whoſe parti-

cles

cles by degrees insinuated themselves into the Pores of the bladder, in plenty enough to resolve the Salt of Tartar into a liquor. And, that it may not be said that the Acrimony of the Salt, by fretting the bladder, made way for the Corpuscles of the Water, I shall add that the Experiment succeeded, but much more slowly, when we tryed it with Sugar instead of Salt of Tartar. And there are some, who pretend that certain Syrups made this slovenly way, which they would have pass for a secret, are very much preferable to those made of common Water.

That the films that line the shells of Eggs are of a very close Contexture seems probable, as by other things, so by their resisting some liquors, sharp enough to corrode the shell, and yet that such Membranes are pervious to Liquors that are none of the most subtile of all, we found by the ensuing Experiment. This was made by taking an ordinary Hens Egg, and keeping it for two or three days in distill'd Vinegar,

or

or in ſtrong crude Vinegar. For then taking it out of the Liquor and wiping it well, it was viſibly, and not inconſiderably, ſwell'd, which I concluded to be from the ingreſs of ſome particles of the liquors, at the Pores of the Skins that inveſt the White of the Egg. For we found nothing broken, though we made the Tryal more than once. And to be ſatisfied that the manifeſt expanſion proceeded from ſome other cauſe, than the meer dilatation of the White, or Yolk, or both, we compared the weight of the Egg, after it was taken out and well wiped, with that which had been taken before 'twas put into the *Menſtruum*, and found the Egg, notwithſtanding the loſs of the Shell, to be conſiderably heavier than 'twas before its immerſion.

I ſhall add on this occaſion that by a more unlikely way than that newly recited, both the Egg, Shell and Lining of an Egg, may be penetrated. For, notwithſtanding the fine and cloſe contexture of the Membranes that inveſt the

the Eggs, the *Chineſes* have a way of Salting them in the ſhell, as I have been aſſured both by Engliſh and Dutch Merchants trading to the Eaſt *Indies*. And in one of the Dutch Journals ſent by the Council of *Batavia* to their Principals in *Holland*, and intercepted by an Engliſh man of War, I met with divers accounts of great numbers of ſalted Eggs, that were ſuch or ſuch a day of ſuch a Month brought in by Sea to *Batavia* or other Ports. Long after which time, meeting with an ingenious Phyſician, that liv'd in *Batavia*, I learned by enquiry from him, that 'tis very true that ſuch Eggs are frequently met with in thoſe parts; he having divers times eaten of them there: ſome that he judged to have been either boyled or roaſted, before they were ſalted; and others that were raw, when they came to be dreſſed for him, but yet retained a Briny taſt. And, though the Merchants I enquired of could not tell me what way the *Chineſes* employed to Salt their Eggs, without making them unfit

unfit for common uſe, yet by a tryal made with clay and Brine, in which I kept the Eggs for a competent time, I was perſwaded that 'twas poſſible the *Chineſes* ſhould have the Art aſcribed to them. For upon the breaking of an Egg coated with clay, after it had lain for a competent time in Brine, I found its Taſt conſiderably Salt, but was, by I know not what accident, hindered from proſecuting the Experiment, and endeavouring to make it more practicable and uſeful.

I knew a Phyſitian of more learning than vertue, who, being tormented with a violent and obſtinate Colic of a peculiar kind, was wont to relieve himſelf by Cliſters of Sack; thô he uſually found that not long after he had taken any of them, they would make him giddy, and fuddle him, as he himſelf confeſſed to me. But upon this Inſtance I lay not much weight, and leſs upon what was anſwered me by a great Chirurgeon, who having practiſed his Art in the *Weſt-Indies*, and being asked by

by me whether he had not dreſſed Wounds and Ulcers with the recent juice of Tobacco (a plant I uſe to keep growing in my Garden for its excellent vertues in cuts, burns, and tumors;) and whether, if he employed it, he did not find it emetick, he told me among other things, that having Divers times dreſſed with this Juice a ſmall Ulcer in a Womans leg, the patient ſoon after the application would grow ſick, and have her ſtomack turned, or actually vomit. But, as I was ſaying, on this inſtance I lay no ſtreſs, becauſe the Corpuſcles of the Tobacco might probably enough get in at the ſmall Orifices of ſome corroded Veſſels, and ſo be conveyed inwards, rather by the help of the Circulation of the blood, than on the account of the Porouſneſs of the Parts. And therefore I ſhall rather mention what has been related to me, by an eminent Phyſician of the famous Colledge of *London*, namely, that he had divers times given himſelf a vomit, by a certain application of decocted Tobacco to

his

his wriſts, and ſome other external parts; which brings into my mind, what is affirmed to have been obſerved in ſome Children that have ſcabb'd Heads, who have been made Drunk, by the application of Clothes or ſpunges wetted in Infuſion of Tobacco, or of ſtrong Liquors, and applied to the part affected. Though in this caſe the inebriating Particles may be ſuſpected to have got in, not at the meer Pores, but rather at the Orifices of the Capillary Veſſels, that were made acceſſible by ſuch little ſolutions of Continuity, as are ſeldom wanting in ſcabbed Heads.

That Children may be purged by outward applications is aſſerted by ſome Phyſicians; and an experienced Perſon of that number has affirmed to me, that he can almoſt conſtantly do it by a Plaiſter. But 'tis more conſiderable what was related to me by an eminent *Virtuoſo*, who being indiſpoſed to believe ſuch things a while before he told me the ſtory, was deſired by a curious Perſon to ſhew him his

his Hand which the Relator having done the other took it in his hand, which was moiſtened (as was afterwards confeſſed) with a kind of ſubtile Chymical Oil, but ſo ſlightly, that the Relator ſcarce minded it, till ſome time after when he found himſelf preſt with a motion, like that which a purge would have given him; for the other thereupon ſmiling, my acquaintance began to ſuſpect what the matter might be, and was in a ſhort time purged four times, without griping, or other pain or diſcompoſure. But to return to the Porouſneſs of Membranes, it may ſerve to make way for your admitting it, to obſerve, that *though* Lute-ſtrings be but Ropes of Fibres (which are at leaſt the chief parts that Membranes conſiſt of) dead, cold and ſtiff, *yet* when the lute is in tune they will ſometimes in wet weather ſwell ſo forcibly as with noiſe and violence to break, which proceeds from the copious ingreſs of moiſt vapors into their Pores, whereby they are not only ſhortened, but as I have tryed in

nice

nice scales, made manifestly heavier.

The Porosity of the internal parts of Animals by both the foremention'd ways (*viz.* of emission and reception of Corpuscles,) may be confirmed by the things that happen in some of the *Metastases* or Translations (as the Physitians call them) of the morbifick matter in diseased Bodies. 'Tis known to them that are any thing conversant with Hospitals, or the observations of Physicians, that there do not seldom occur in Diseases sudden Removes of the matter that caused them, from one part to another according to the nature and functions of which, there may emerge a new Disease, more or less dangerous than the former, as the invaded part is more or less noble. Thus oftentimes the matter, which in the sanguiferous Vessels produced a Feaver, being discharged upon some internal parts of the Head, produces a *Delirium* or *Phrenitis*; in the latter of which I have somewhat wondered, to see the Patients Water so like that of a Person without a Feaver; the same

Febril

Febrile matter either by a deviation of Nature, or medicines improper or unskillfully given, is discharged sometimes upon the *Pleura*, or Membrane that lines the sides of the Chest; sometimes upon the throat; sometimes upon the Guts; and causes in the first case a Pleurisie, in the 2d a Squinancy, and in the third a Flux, for the most part dysenterical. But, because I suppose, that many, if not most, of these translations of peccant humors, are made by the help of the circulation of the Blood, I forbore at the beginning of this Section to speak in *general terms*, when I mentioned them in reference to the Porousness of the internal parts of the Body, and contented my self to intimate, that *some* of them may serve to confirm that Porosity.

This will not perhaps seem improbable, if we consider that 'tis in effect already proved, by the same arguments by which we have shewn, that both the Skin and the internal Membranes are furnished with Pores, Permeable by Particles whose Shape and

Size are correspondent to them. For we may thence probably deduce, that when a morbifick matter, whether in the form of Liquor, or of exhalations, chances to have Corpuscles suited to the Pores of this or that part of the Body, it may, by a concourse of Circumstances, be determined to invade it, and so dislodge from its former receptacle, and excite Disorders in the part it removes to.

CHAP. IV.

ANother thing whence the Porosity of Animals may be argued, is, their taking in of *Effluvia* from without. For these cannot get into the internal parts of the Body, to perform their operations there, without penetrating the Skin, and consequently entring the Pores of it.

Now, That things, outwardly applyed to the Body, may without wounding the Skin, be convey'd to the internal parts, there are many things that argue. And

And first, it has been observed in some Persons, (for all are not equally disposed to admit the action of particular Poysons) that *Cantharides*, being externally apply'd by Chyrurgions or Physicians, may soon, and before they break the Skin, produce great disorders in the Urinary Passages, and sometimes cause bloody Water. And I remember, that having once had a blistering Plaister, applyed by a skilful Chyrurgion between my shoulders, though I knew not that there were any *Cantharides* at all mixt with the other Ingredients, yet it gave me about the neck of my Bladder one of the sensiblest pains I had ever felt, and forced me to send for help at a very unseasonable time of night.

The Porousness of the Skin may be also argued from divers of the effects even of Milder Plaisters. For, though some Plaisters may operate as they closely stick to the Skin, and hinder Perspiration from within, and fence the part from the external cold; yet, twill scarce be denied, that

many of them have notable effects upon other accounts, whereof none is ſo likely and conſiderable as the copious ingreſs of the Corpuſcles of the Plaiſter, that enter at the Pores of the Skin, and being once got in, act according to their reſpective Natures & Vertues. The like may be ſaid of Ointments, whoſe operations, eſpecially on Children (whoſe Skin is ordinarily more ſoft and lax) are ſometimes very notable. And I have known conſiderable things performed by them, in an internal Diſeaſe of grown men, where I ſhould ſcarce have expected a Vegetable Ointment ſhould perform ſo much: I ſay, a Vegetable Ointment, for 'tis vulgarly known that by Mercurial Ointments Salivation may be excited; and ſometimes, againſt the Phyſitians will, the Corpuſcles of the Quick Silver get ſo far into the Body, that he is not able to get them out again.

What we lately ſaid of Plaiſters, may be applyed to thoſe that Phyſitians call *Pericarpia*, or Wriſt-bands: The

The better ſort of which, though ſometimes ineffectual, are oftentimes ſucceſsful in ſtopping Fits of Agues, as I have frequently found in a mixture, elſewhere mention'd, of Currans, Hops, Bayſalt well beaten together, by which, by Gods bleſſing, many, and I among others, have been freed from ſimple Tertians, and either double Tertians or Quotidians.

The Argument of the Poroſity of Animals, drawn from thoſe things that get in through their skins, without breaking or wounding them, may be much ſtrengthned, if it can be made appear, that thoſe Phyſitians do not deceive us, who aſcribe ſenſible Operations and Vertues, to things externally applyed, in ſo looſe a way, that they do not ſo much as ſtick to the Skin, or perhaps immediately touch it; ſuch as ſome call *Periapta* and *Appenſa*; divers of which are beſt known among us, by the name of Amulets; ſuch as are the Quills containing Quick-ſilver or Arſenick, that ſome hang about their necks, and

wear under their Shirts, againſt the Plague and other Contagious Diſeaſes; and the Bloodſtones that others wear againſt Hæmorrhages; and the ſtone which the Women uſe in the *Eaſt-Indies*, for a quite contrary effect, in *Obſtructione Menſium*. That many of theſe external Medicines, anſwer not the promiſes of thoſe that extol them, having ſome of them no ſenſible operation at all, and others no conſiderable one, experience has aſſured judicious obſervers; but that ſome of them, eſpecially on ſome Patients, may have conſiderable, not to ſay admirable, operations, I confeſs my ſelf by other motives, as well as Authority, to be perſwaded. Having been one ſummer frequently ſubject to bleed at the Noſe, and reduced to imploy ſeveral remedies to check that diſtemper; that which I found the moſt effectual to ſtanch the blood, was ſome moſs of a dead mans Scull (ſent for a preſent out of *Ireland* where 'tis far leſs rare than in moſt other Countrys) though it did but touch

touch my skin till the herb was a little warm'd by it. And though I remember not that I have known any great matter done to ſtop Hæmorrhagies by the bare outward application of other Blood-ſtones; yet of one that look'd almoſt like an Agate, I admired the effects, eſpecially upon a young and extraordinarily Sanguin perſon. To which I ſhall add a memorable thing, communicated to the experienced *Zwelfer* by the chief Phyſitian of the States of *Moravia*. For this learned man whom he extols for a great Phyſician and Philoſopher; aſſures him, that having prepared ſome Trochiſchs of Toads according to *Helmonts* way, (which I remember I alſo was ſolicitous to prepare, but had not occaſion to make tryal of their vertue,) he not only found, that being worn as Amulets they preſerved him and all his Domeſticks, and Friends, from the Plague (though he daily viſited the infected) but that having cauſed theſe

If one would ſee this paſſage at large he may find it at the end of the Eſſay.

Trochiſchs to be put upon the Plague ſores of ſeveral perſons, none of them died, but the venom of the peſtilential Carbuncles was thereby ſo weakened that the ulcers were afterward eaſily cured by vulgar remedies.

And now, as to the difficulty, which I acknowledge not to be ſmall, to conceive how Bodies actually cold can emit *Effluvia*, capable of penetrating (without moiſtening it) a Membrane of ſo cloſe a Contexture as a mans Skin; I ſuppoſe it will be much leſſened in the objectors opinion, by what he will meet with hereafter about the Pores of Bodies, and the Figures of Corpuſcles. For ſuppoſing theſe to be congruous, it will not ſeem incredible, that the *Effluvia* of Amulets ſhould in tract of time get paſſage through the Pores of the Skin of a Living Body. And to make this the more probable, I will give an Inſtance in the Skin of a dead *Animal*. And, becauſe this requires a Liquor I much employ in theſe trials about Porology, though I have many years ſince in another

another Tract taught how to make it for another purpoſe; yet I ſhall here repeat, that 'tis made by exactly mingling Flower of Brimſtone, powdered *Sal Armoniac* and good Quicklime in equal quantities, ſave that, if the Quicklime be not very dry and good, a fourth or fifth part muſt be ſuperadded, for theſe being nimbly mixed, and diſtilled by degrees of Fire in a Retort, till the Sand be at length brought to be almoſt red hot, there will come over a ſmoaking Spirit, which muſt be kept very carefully ſtopt, and which for diſtinctions ſake, I alſo uſe to call, The *Permeating Menſtruum or Liquor*, and its expirations the Penetrant, or Permeating Fumes.

And now you will eaſily underſtand the experiment I was about to mention, which was this; We took a very clean piece of poliſh'd Copper, in want of which one of ſilver will ſerve the turn, and having lapt it up in a piece of either Lambs or ſheeps Leather, ſo that it was every way incloſed,

inclosed, we then held it over the Orifice of the Vial that contained the Spirit, at a pretty distance from the Liquor, whose fumes nevertheless did quickly, (perhaps in a minute of an hour or less) pervade the Pores of the Leather, and operate upon the included metal as appeared by the deep and lasting tincture it had given to the lower surface of it, though the interposed Leather it self was not deprived of its whiteness, nor at all sensibly discoloured; however it smelt of the Sulphureous steams that had invaded it. And, if I misremember not, the same Experiment succeeded, though somewhat more slowly, when a double Leather was interposed between the fumes and a new piece of Copper coin. This will be thought the less strange, when I shall come to some other Instances of the Penetrancy of these Spirits. In the mean while I leave it to be considered, whether this may not suggest some conjecture at that strange *Phænomenon*, which is recorded by Authors of good repute,

That

That ſometimes in great Thunders the Lightening, among other operations, has been found to have manifeſtly diſcoloured mens money, without burning the Purſes or Pockets wherein it lay. For in our experiment, the ſteams that in a trice pervaded the Leather, the moſt uſual matter whereof Purſes are made, were ſulphureous, as the ſmell argues, that thoſe which accompany the *Fulmen* are wont to be; and whereas theſe, when they invade Bodies, are uſually very hot, ours operated when the Liquor that emitted them was actually cold. And if it be ſaid, that ſometimes their money has been found diſcolored in their Pockets, who were not ſtruck, by the *Fulmen*, but had it only paſs near them, it may be objected, that tho the intire Body, whether fluid or ſolid, if there be any of this latter kind that is in Latine called *Fulmen* (for our Engliſh word, *Thunderbolt* ſeems not ſo applicable to a fluid) did not touch them, yet it might ſcatter ſteams enough round about it, to cauſe the

the *Phænomenon*. For confirmation of which I shall take notice, that a considerable Person of my acquaintance, having had the Curiosity to ascend a burning mountain in *America*, till the sulphureous steams grew too offensive to him, he told me that, among other operations he observed them to have upon him, one was, that he found the money he had about him turned of a black and dirty colour, such as I have observed our sulphureous steams often give both to Copper, and to Silver Coins. But whether or no our Spirits will justify the conjecture, they invited me to mention, at least their so easily pervading the Skin of a dead Animal may make it probable, that the Skin of a Living man may be easily penetrated by external steams whose approach the Eye does not perceive, and whose operations, though not inconsiderable, may therefore be unsuspected. I leave to Physitians to consider, what use may be made of this observation, in reference to the propagation of contagious Diseases, by the contact of infected

infected Air, distinct from the Respiration of it, and by the penetration of the steams, that issuing from divers Bodies invade the Skin, and may perhaps be capable of operations, either hurtful or friendly, that are not usually suspected to proceed from such causes, and are therefore misascribed to others. And on this occasion it will not be impertinent to add, that by hanging up sheeps Leather or Lambs Leather in the free Air, the vapors of it would so insinuate themselves into the Pores in wet weather, that a moderate degree of moisture in the Air would add to it a not inconsiderable weight, of which dry weather, whether hot or cold, would deprive it.

CHAP. V.

I Must not in this place omit some Instances, very proper to manifest the Penetrableness of Membranes to Fumes themselves, if they be subtile enough

enough for their Pores, or correspondent enough to them.

Among the observations published by Physicians I have met with some by which it appears that *Cantharides* may have great Effects upon the internal Parts of the Body, though they do not so much as touch the Skin, but are placed at some distance from it, so that their *Effluvia* must be transmitted through other Bodies before they can penetrate that. The learned *Michael Paschalius* mentions a Chyrurgion, who was twice brought to void much Blood with his Urine, by some Spanish Flies that he carryed about in a Purse or Bag. And another Doctor of note relates of another person that came to complain to him, that he pissed Blood, having carryed about with him *Cantharides*, though in his Pocket, and adds, that a like Case was recounted to him by *Helidæus*, whom he calls an eminent *Bolognian* Physician.

Schenkii Observationum Lib. 7. Obs. 37.

We see, that in Linnen Cloth, the finer

finer and more ſlender the threads are the cloſer and leſs Porous, *cæteris paribus*, the Linnen is: By analogy to which one may eſteem the thin film that lines the ſhell of an Egg, to be of an exceeding cloſe Contexture; and yet that even this film is not impervious to ſome Fumes, I have found by the following Tryal.

To make this, we ſlowly and warily pick'd off a ſufficient part of the Shell of a Hens Egg, from the Skin that lay juſt beneath it, and is wont to ſtick ſo cloſe to it, that their ſeparation, without injuring the Membrane, is not eaſy. In this Skin, being wip'd, we wrapt up a flat piece of Copper, whoſe ſurface was made bright, that the change of Colour might be the better ſeen; and having kept this covered bit of Plate, over the Fumes of our ſmoaking Liquor lately mentioned for a minute or two by our gheſs we unfolded the Skin, and found, as we expected, that the lower ſurface of the Copper which was it that had been held over the Fumes,

Fumes, was turned of a very dark colour, which manifested that even so fine and closely contexed a Membrane was not only, as we have formerly shewn, penetrable by Liquors, but readily pervious to our sulphureous exhalations, tho these were probably but faintly emitted, since the Liquor they came from was then actually cold. But in making the Tryal it is fit to hold (as we did in that newly recited) the Membrane against the light, to see if it be intire, and have escaped all those little lacerations that are hardly avoidable in severing it from the Shell it sticks so close to. If this caution be neglected, 'tis easy to be imposed on, by overlooking some little holes, that are not easily discerned when one looks down upon the Skin, and yet may be sufficient to make the Experiment deceitful. But, thô when 'tis well made, it is a notable confirmation of the Doctrine endeavoured to be established in this Paper, yet I shall now subjoyn a more considerable

Instance

Inſtance to the ſame purpoſe.

The Porouſneſs of the Internal Membranes of the Body, will be more eaſily granted, if it be conſidered that either the Liquors, or the moiſt Exhalations, whoſe Action is promoted by the Natural Heat of the Parts, keeps them conſtantly wet or moiſt, and thereby renders them more lax, and more penetrable by ſubtle Spirits or other Corpuſcles. In favour of this Reflection I made the following Experiment. We took a piece of a dryed Urinary Bladder, which was judged to have been a Calfs; and having lapt it about a new piece of Silver Coin, ſo that the Bladder was ſingle where it covered the lower ſide of the Piece, we kept it for divers Minutes, by gueſs, over the Spirituous Fumes of our often mentioned Permeating Liquor, but could not perceive that the Coin was thereby at all affected or terniſhed. Whence we concluded that the Pores of the dry Bladder were too cloſe and narrow, to give paſſage to the Expirations of

the *Menſtruum*. But preſuming that moiſture would ſome what relax them with another piece of the ſame Bladder, made limber by being a little wetted in common Water, we lapt up another like peace of new Coin, as we had done the former, and kept it at the ſame diſtance as before, from the Liquor, but not for ſo long a time. For after about two Minutes, by gueſs, we remov'd and took out the Piece, and, as we expected, found much of its lower ſurface (that regarded the Liquor) deeply diſcoloured. Which Experiment will not only juſtify what I lately ſaid, of the greater Laxity of moiſt than of dry Membranes, but will be thought no mean confirmation of what is in this Eſſay delivered about the Poroſity of Membranes, ſince the Urinary Bladder does, as Anatomiſts well know, conſiſt of more than one Membrane, though they ſtick ſo cloſe together, as to appear but one to the Eye. And this Bladder was ſpeedily penetrated by the

the Fumes that our Liquor emitted in exceeding Cold and Frosty weather, though the Bladder it self was not in the warm Body of the live Animal, but had been so long kept dryed and cold, that probably the Moisture it introduced in scarce one minute of an Hour, could not restore it to the Laxity it had, whilst it was a part of the living Calf.

One of the notablest Instances I ever met with, of the Porosity of the Internal Membranes of the Humane Body, was afforded me by that *British* Nobleman, of whom our famous *Harvey* tells a memorable, not to say matchless, story. This Gentleman, having in his youth, by an accident which that Doctor relates, had a great and lasting Perforation made in his *Thorax*, at which the motion of his Heart could be directly perceiv'd did not only out live the accident, but grew a strong, and somewhat corpulent man; and so robust, as well as Gallant, that he afterwards was a Souldier, and had

the honour to command a Body of an Army for the King. This Earl of *Mount-Alexander* (for that was his last Title having marryed one of my nearest kinswomen, and having been told that I was very desirous to see, what I had heard such strange things of, very obligingly came, at a fit time, to give me that satisfaction. In order to which he removed that which covered the wide Orifice of his Hurt, and gave me the opportunity of looking into his *Thorax*, and of discerning there the motions of the Cone, as they call it, or *Mucro* of the Heart. But these things I mention but upon the by, and because of the strangeness of the fact; the thing I principally intended relates to my present argument. Having then made several inquiries fit for my purpose, his Lordship told me, that when he did, as he was wont to do from time to time, (though not every day) inject with a Syringe some actually warm medicated Liquor into his *Thorax*, to cleanse and cherish the Parts,

Parts, he ſhould quickly and plainly find in his Mouth the taſt and ſmell of the Drugs, wherewith the Liquor had been impregnated. And I further learned, that, whereas he conſtantly wore upon the uncloſed part of his Cheſt, a Silken Quilt, ſtuffed with Aromatick and odoriferous Powders, to defend the neighbouring Parts and keep them warm; when he came, as he uſed to do after ſome weeks, to imploy a new Quilt, the fragrant *Effluvia* of it would mingle with his breath in exſpiration, and very ſenſibly perfume it, not, as I declared I ſuſpected, upon the ſcore of the pleaſing Exhalations that might get up between his Clothes and his Body, but that got into the Organs of Reſpiration, and came out with his Breath at his Mouth, as was confirmed to me by a grave & judicious Stateſman, that happened to be then preſent, and knew this General very well. Other circumſtances I might add, but that I dare not truſt my memory for them, and unhappily loſt the Paper,

wherein the oddness of the things invited me to set them down, for fear of forgetting them.

That part of this Narrative which relates to Injections may be much confirm'd by what is delivered by *Galen* himself, who says that *Mulsum* or *Honeyed Water*, being injected at the Orifice of Wounds penetrating into the cavity of the *Thorax*, has been observed to be in part received into the Lungs, and discharged out of the *Aspera Arteria* by coughing. And this he mentions as a known thing, imploying it as a *Medium* whereby to prove another.

The mention that has been made of the Porosity of Membranes, brings into my mind what I once observed at the Dissection, made by some Physicians, and Anatomists, of a lusty Souldier, that was hanged for I know not what crime. This man, though otherwise young and sound, was observed to have been long molested with what they call a *short, dry Cough*, which made us expect to find something

thing much amiſs in his Lungs. But meeting with nothing there, we were at a loſs for the cauſe of this Cough, till coming to conſider the internal part of the Cheſt, we perceived ſomething on one of the ſides, by tracing of which we diſcovered, that between the *Pleura* and the ſubſtance of the intercoſtal muſcles, there was lodged a certain matter, of the breadth of a Silver Crown piece, or thereabouts, of a roundiſh figure, and of the conſiſtence and almoſt colour of new, ſoft Cheeſe, which odd ſtuff was concluded to have been the remains of ſome ill cured Pleuriſy, and to have tranſmitted through the Pores of the *Pleura*, though that be a very cloſe Membrane, ſome noxious *Effluvia*, which ever and anon irritated the Lungs into an irregular and troubleſom motion, and ſo produced the Cough the Malefactor had been moleſted with.

CHAP. VI.

I Am well aware that 'tis far less difficult, to prove the permeableness of single Membranes, than that of such a Part of the Body, as seems to be an aggregate of several parts, which in regard of their close adhesion, are looked upon but as one part, to which, on that account, men commonly give a distinct name. But yet there are some *Phænomena* that seem to argue, that even such compounded or resulting parts, if I may so call them, are not destitute of Pores, which whether they be not some of them the Orifices of exceeding slender and therefore unobserved Capillary Vessels, I must not now stay to enquire.

When the cavity of the *Abdomen* in those Hydropical Persons that are troubled with an *Ascites*, is filled with Water, or rather with a Liquor that I have found to be much more viscous, it justly appears strange, that by an Hydra-

Hydragogue, or ſome appropriated purging medicine, great quantities of this groſs Liquor ſhould in a ſhort time be carryed off by Siege, and perhaps alſo by Urine, though to get into the cavity of the Guts, or that of either of the Kidneys, it ſeems neceſſary that it Permeate the Tunicles, and other component parts, of the *Viſcera* it gets into.

I know not whether I may on this occaſion take notice of what Phyſicians obſerve to occur now and then in *Empyema's* that follow ill conditioned *Pleuriſies*. For it has ſeveral times been obſerved, that upon the burſting of ſuch impoſthumes into the cavity of the Cheſt, the Purulent matter hath been voided by Siege and Urine. I heſitate, as I was ſaying, whether I ſhould alledge this *Phænomenon*, as a proof of what I now contend for, till it be determined whether this *Metaſtaſis* be made by *tranſudation* properly ſo called, or by the ingreſs of the *Pus* into the imperfectly cloſed Orifices of the Veſſels of the Lungs; where

where being once admitted and mingled with the Blood they may with this circulating Liquor arrive at the Kidneys, or any other Parts fitted to make a secretion of this Heterogeneous matter.

But whatever be the Reason or manner of it, we find that the Lungs do sometimes odly convey things to distant parts of the Body. And if I may here mention a thing, *cui honos præfationis est*, I shall add that I have several times observ'd in my self, that when I had been an actor or an assistant in the Dissection of a living Dog, especially if his Blood or Body were rankly Scented, I should divers hours after plainly find that odour in the excrements I voided by Siege.

A famous Chirurgeon and Anatomist relates, that one who was very ill of a dropsy, judged to arise from a *Scirrhus* of the Spleen, coming to ask his counsel and assistance, though he judged the patients case desperate, yet to content him, he ordered him to dip a very large Sponge in good Quick-lime.

lime-Water, and having ſqueezed out the ſuperfluous Liquor, to bind it upon the region of the Spleen, only ſhifting it from time to time. He adds, that after ſome months he was much ſurprized to receive a viſit from this Patient, with ſolemn thanks for his recovery; the outward Medicine having, it ſeems, reſolved the *Scirrhus* and concurred with nature to evacuate the hydropical humour. For the reſolution of which hard tumour it ſeems neceſſary, that the ſanative Corpuſcles of the external remedy ſhould at length penetrate, not only the *Epidermis*, and the true *Cutis*, but the Muſcles themſelves of the *Abdomen*, and ſome other interpoſed parts.

Theſe inſtances may be ſtrengthen'd by an eminent obſervation of *Galen*, who takes notice that Bones being ſometimes broken, without piercing the Skin that covers the part they belong to, when the *Callus* is making, and the broken parts of the Bone begin to be conglutinated together, a Portion of

of that Blood which had flowed to the part affected is carryed to the Skin and permeats that, so as to wet and foul the Dressings or Bandages that are kept upon the limb affected by the Fracture.

CHAP. VII.

Bones, *Horns*, and parts of the like Substance, being those that are granted to be the most solid of the Bodies of Animals, I come in the last place to shew by particular Experiments that these also have their *Pores*. I say, by particular Experiments, because in a general way, their *Porosity* has been already proved, by the same Arguments, from their original Texture, Nutrition, Augmentation, &c. That have been employed to manifest the *Porousness of Animal Substances in general*.

That the Nails of men, as well as their *Skins*, are Porous, may be gathered from their being easily and permanently

permanently tinged with divers metalline ſolutions, and particularly with thoſe of ſilver in *Aquafortis*, and Gold in *Aqua Regia*; the former of which ſolutions though cold, will but too eaſily tinge the Skin and Nails it chances to touch, and makes ſome little ſtay upon, with a dark and blackiſh colour; which I found not that I could waſh out with water, or, even with a far more penetrating and abſterſive liquor. The like durableneſs I found in the Purple ſpots, that I ſometimes purpoſely made on my Nails, by letting ſome little drops of the ſolution of Gold in *Aqua Regia* dry upon them, which I now and then did, to obſerve the way of the Nails growth. For if the ſtain were made near the root of the nail, it would be ſtill, though very ſlowly, thruſt on by the new matter, till after ſome weeks it arrived to the further end of the Nail, and was fit to be pared off with it. But this only upon the by. 'Tis more to our purpoſe to take notice, that, though the *Menſtruums* imployed in the recited Experiments

Experiments be of themſelves very acid and corroſive, yet they are ſo changed by the metals they have diſſolved, that they are Acid no more, the ſolution of Silver being rather extreamly bitter, and that of Gold of a kind of *Stiptic* taſt, almoſt like that which ſloes, growing in the hedges, are wont to be of.

Ivory is a thing too well known to need to be deſcribed. And, ſince 'tis generally lookt upon (for I have had no opportunity to compare it with the Bones) as the ſolideſt part of the vaſteſt of Tereſtrial Animals, Experiments proving its poroſity, will be ſtrong preſumptions for that of the hardeſt parts of other Animals. And the Porouſneſs of Ivory may be argued from the ſeveral ways of dying it with permanent colours. For in theſe colorations the Tinctures that make them, muſt penetrate into, and be lodged in the Subſtance of the Ivory, eſpecially when the Subſtance remains ſmooth and glaſſy, as I have divers times made it do, when I employed

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fit *Menſtruums* and Metalline Pigments. The ſolution I formerly mentioned of Silver in *Aqua fortis*, being laid upon Ivory, will ſoon give it a dark and blackiſh ſtain, which is not, that I have found, to be waſhed off. I remember alſo that I many years ſince taught ſome ingenious artificers, to adorn Ivory with a fine purple colour, by moiſtening it with, and ſuffering leiſurely to dry on it, a ſolution of Gold made in *Aqua Regia*. And if occaſion required, allayed with water, nor needs either of theſe ſolutions be applyed hot, any more than the Ivory needs to be heated. Both which circumſtances favour the Porouſneſs of the ſolid Body.

Copper diſſolved in *Aqua fortis* ſtains Ivory with a blewiſh colour, as I have ſometimes ſeen in the hafts of knifes, about whoſe coloration nevertheleſs another way is alſo employed. But I remember that without making uſe of any Acid or Corroſive *Menſtruum*, I have even in the cold ſtained Ivory, with a fine and permanent blew,

blew, like a Turquois, by suffering to dry upon it as deep a solution as I could make of Crude Copper, in an urinous Spirit, as that of *Sal Armoniack*.

But now to return to Bones, their growth in all their dimensions, does, as I lately noted, argue their Porosity and the marrow that is found in the great hollow Bones, whether it nourish them or no, must it self be supplyed by some alimental juice, that soaks or otherways penetrates, into the cavities that contain it.

Nor does it seem at all improbable, that Blood it self may through small Vessels be conveyed into the very substance of the Bone, so as that the Vessels reach at least a little way in it, though perhaps the Liquor they carry may afterwards by Imbibition be brought to the more internal parts of the Bone. For not to urge that we manifestly see, that on each side of the lower Jaw, Nature has been careful to perforate the Bones and make a Channel in the substance of it; which Chan-

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nel receives not only a larger Nerve but a Vein, & Artery to bring in & carry back Blood for the nouriſhment of the Teeth, by diſtinct Sprigs ſent from the great branch to the particular Teeth. Not to urge this, I ſay, (which I mention but to ſhew that the opinion lately propoſed is agreeable to a known practice of Nature) I have been aſſured by eminent Anatomiſts, whom I purpoſely conſulted, that they have obſerved Blood-veſſels to enter a great way into the ſubſtance of the larger Bones. And one of them affirmed, that he had traced a Veſſel even to the great Cavity of the Bone. Which I the leſs ſcrupled to admit, becauſe it has been obſerved, that in younger Animals the Cavity is in great part furniſhed with Blood as well as Marrow, and in thoſe larger Pores, whereof many are found in the more Spongy Subſtance of divers Bones, Blood has been obſerved to have been lodged, as alſo in the ſpongy part of the Skull, that lies between the two Tables, as I have been aſſured by Skilful Eye-witneſſes.

The blackneſs alſo, that Bones acquire when put into a competent heat, and a peculiar kind of fatneſs which they may by heat be made to afford, ſhew that they harbour, even in their internal parts, ſtore of Unctuous Particles, ſeparable from the ſolid ſubſtance, (which ſtill retains its ſhape and continues ſolid) in whoſe Pores they may thereby be argued to have been lodged. The Lightneſs of Bones, even when their Cavity is acceſſible to (Air and) Water, is alſo a great ſign of their Poroſity. And ſo is their being corroded by tinging liquors, if they be penetrative and well applyed. I know not whether I ſhould add on this occaſion, that having taken calcined and pulverized Bones, ſuch as we uſe to make our Cupels of, and, after having given them a good heat, kept them for ſome time in the Air, but in a well covered place; I found the imbibed moiſture of the Air to have manifeſtly increaſed their weight; and that I alſo obſerved in a curious *Skeleton*, where

where the Bones were kept together by wires, instead of other Ligaments, that though I kept it in a well covered place, not far from a Kitchin Fire, yet in very moist weather the Bones seemed to swell, since those joynts that were easy to be bent, in dry weather, and that after several manners, would grow stiff and refractory, and indispoled to be put into such motions, when the weather was considerably wet. These particulars (as I was saying) I am somewhat doubtful whether I should here insert, because one may suspect the *Phænomena* may proceed rather from somewhat else, than the imbibed moisture of the Air; and yet I would not omitt to mention these observations, because I do not yet see any cause to which they may more probably (or indeed so probably) be assigned.

And on this occasion I shall subjoyn some observations made on large and solid Ox Bones, which in one of my Note Books I find thus registred. *Nov.* 15. We weighed two [entire or unbroken]

broken] Marrow Bones, and found the one to weigh ℥xxix + ʒß, and the other ℥xxiv + ʒiv + 30 gr. *Nov.* 24. The former weighed ℥xxix + ʒvi, and the latter ℥xxv + ʒi + 30 gr. *Decemb.* 28. the former weighed ℥xxix + ʒiij. 55 gr. and the latter ℥xxiv + ʒvii. + 39 gr. *June* 7th of the following year, the former weigh'd ℥xxix + ʒii. And the latter ℥xxiv + ʒvii. By which obſervations purpoſely made at differing times of the year, and in very good ſcales, it ſeems that Bones do plentifully enough imbibe the Exhalations of the Air, and emit them again, together with ſome of their own, according as the ambient happens to be diſpoſed. And theſe alterations argue the Bones to abound with Pores, ſince the external ſteams muſt have Pores to receive them, and the *Effluvia* muſt upon their receſs leave Pores behind them.

I confeſs that to think (as with ſome Anatomiſts I lately ſeemed to do) that Bones themſelves admit into their ſubſtance, Veſſels capable of conveying

conveying a nutritive Liquor, we must suppose those Vessels extreamly slender. But that 'tis not only possible but somewhat credible, there may be such, I am induced to think, by what is known to happen in that disease, which from the Country it most infests is called the *Plica Polonica*. For, tho one would think that the hairs of men are much too slender, to have cavities in them capable of visible Liquors; and though I have found it very difficult, even with a good Microscope, to perceive any cavities in the hair of a man transversly cut; yet not only some other writers of good note, but the Judicious *Sennertus* himself deliver, that in this disease (of which he particularly treats) it has been observed, that if the Patients cause their intangled hair to be cut, as they sometimes do, by reason of its nastiness or unsightliness, they are not only thereby endangered, but sometimes the single hairs will actually bleed, where the ends have been cut off; so that so thick a Liquor as Blood may be conveyed

through Vessels, that can at most be but in a proper sense *Capillary* and must be far less than hairs, if their Perforations be like those by which many Plants have their nourishment conveyed to them, or such as are obvious in divers Canes, which being cut quite through transversly, discover a multitude of distinct Pores, that by some Experiments one may be induced to guess, reach all along, and make the Cane like a Cylindrical Bundle of Minute Pipes; or rather a multitude of small cavities, that perforate from end to end the *Parenchyma*, or Substance analogous to it, that gives them stability. And for the present this sort of Vessels seem to me, the more likely to be those that convey the Blood to the extream Parts of the Hair, because even in Horse hairs, which yet are nourished and grow, I am not yet sure, that I have discovered with my Microscopes any cavity, and therefore suspect there may be divers imperceptible ones, for the Hair is nourished and grows, which it is not like

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t ſhould do if the Body were ſolid; and if there were but a ſingle cavity in it, as in the lower part of a Quill, 'tis like the Microſcope I uſed would have diſcovered it, ſince with one much inferiour I could eaſily ſee, that ſeveral little ſhort Hairs, that grow upon the Animal that yields Musk, had each of them a cavity in it like that of the lower part of a Quill.

To the things that have already been ſaid about the Poroſity of Bones, I ſhall now add an obſervation of a very learned Phyſician, that is very remarkable to our preſent purpoſe, becauſe it argues, that even Bodies not ſaline, nor actually moiſt, may from without get into the Pores and Cavities of Humane Bones. Divers Phyſicians have complain'd of the miſchiefs done to the Bones by Mercury, employ'd to ſalivate in Venereal Diſeaſes. Whereof I remember I have read a very notable Inſtance, in a learned Book (which I have not now by me) of an eminent Roman Profeſſor of Phyſick, who had the oppor-

tunity of making several curious observations in the famous Hospital of the *Incurabili* at *Rome*; and is therefore the more to be credited; where he relates, that in the Cavity of at least one Pocky-mans Bones, there was found real Quick-Silver that had penetrated thither. And this brings into my mind a memorable observation of an ancient and experienced Physician, who being famous for the cure of Venereal Diseases, was asked by me, what Instances he had found of the Penetration of Quick-Silver, either outwardly or inwardly administred, into the Bones of men? To this he answered, that he could not say he had himself taken notice of any Quick-Silver, in the Cavities of greater Bones, but that some other Practitioners had told him, that they had met with such Instances, as I enquired after. But for himself, he only remembred that a Patient, who had been terribly fluxed with mercurial Inunctions, coming afterwards to have one of the Grinders of his lower Jaw pulled out, because

becauſe of the raging pain it had long put him to; my Relater had the curioſity to view narrowly this great Tooth, and found, to his wonder, a little drop of true Mercury in that ſlender Cavity of the Root, that admits the ſmall Veſſels which convey nouriſhment and ſenſe to the Tooth, in more than one of whoſe three Roots he affirmed to me that he found true, though but exceeding little, Quick-Silver. But a full Teſtimony to my preſent purpoſe is afforded me by the experienced Phyſician *Euſtachius Rudius*, who relates, that he ſaw himſelf, and that others alſo obſerved, ſome Bodies diſſected, of thoſe that had been anointed for the Venereal Pox, in the Cavities of whoſe Bones no ſmall quantity of Quick Silver was got together, (which yet (to add that upon the by) he ſays, did not hinder ſome of them from living many years, ſurviving thoſe Inunctions.)

Euſtach. Rudius (apud Sennertum) lib. 5. de morbis acutis cap. 15.

CHAP.

CHAP. VIII.

I Am not ignorant that, among the Particulars laid together in the foregoing Eſſay, there are ſome that are not abſolutely neceſſary, to prove the Porouſneſs of the Bodies of Animals. But I thought it not impertinent to mention them, becauſe I hoped that they, in conjunction with the reſt, may be of ſome uſe to Naturaliſts, in giving an account of ſeveral things that paſs in a Humane Body, whether ſound or ſick, eſpecially if it be of a Topical diſeaſe, and may remove, or much leſſen that great Prejudice, that makes many (and ſome of them otherwiſe learned) Phyſicians deſpiſe the uſe of all *Amulets*, *Pericarpia*, and other external Medicines in Diſtempers of the Inward parts, upon a confident, but not well grounded ſuppoſition, that theſe Remedies immediately touching but the outſide of the Skin, cannot exerciſe any conſiderable operations

tions upon the internal parts of the Body.

But though I have thus acknowledged ſome Paſſages of the foregoing Eſſay to be ſupernumerary, yet I muſt not diſmiſs it without intimating that I might from one Topick more have fetched a probable, though not a demonſtrative argument, in favour of the Porouſneſs of Animals. For this may be very probably argued from hence, that even Inanimate, Solid and Ponderous Bodies, that in all likelyhood muſt be of a far cloſer Texture than the living Bodies of Animals (whoſe various Functions require a greater number and diverſity of Pores in their differing Organs) are not devoid of Pores, and have ſome of them very numerous ones, as will be ſufficiently made out in the following Eſſay, to which I ſhall therefore haſten.

N. B.

N. B. The following Paper is that which is refer'd to in the 35th Page of this Eſſay.

Pharmacopœiæ Regiæ claſſis xiii. *pa.* 614. 615.

Hujus rei veritatem comprobat Doctiſſimus ac celeberrimus Medicus & Philoſophus D. Johannes Chryſoſtomus *Irmbler, Statuum Moraviæ Marchionatûs Protomedicus, his verbis ad me ſcribens: Et revera paravi ego, Anno M.* DCLV, *quo tempore inter Infectos verſabar quotidie, Trochiſcos Bufonios, eóſque ut cætera Helmontii, indefeſſi veritatis indagandæ, & ex puteo Opinionum veterum noſtram credulitatem excæcantium eruendæ, nati Philoſophi, experimenta ſuas laudes ſuſtinere comperi: Inter, viginti autem Bufones vix unum quidem, jucundo ſane ſpectaculo, vidi vermiculos, per nares & oculos egreſſuros, manu repellere quamdiu pterat, donec elanguerit Bufo: ſed Trochiſcos ex vermiculis unà cum pulvere emotui bufonis, & materiâ per anum (nondum*

dum vidi per vomitum;) ſcilicet alis, pedibus, capitibus, ventribus Scarabæorum viridibus, auratiſve & nigris, quos bufo cum terra in eſcam venatur, ejectâ, cerea patinâ exceptis, cum Tragacantho roſato formatos, pluribus perſonis ſuper anthraces opponi feci, atq; nullum eorum mortuum eſſe dicere poſſum, ſed & meorum domeſticorum, ut & aliorum, quibus dedi, amicorum nullus, quod ſcio, infectus eſt. Sic comperi non tantùm hiſce Trochiſcis enervari virus peſtilens in Carbunculo jam admiſſum, ut dein vulgaribus chirurgicis remediis ulcus facili negotio fuerit curatum, ſed etiam ad ſiniſtram mammam ligatos, mihi meisque accurſui & occurſui infectorum expoſitis, animoſitatem quandam indicibilem conferre, atque ita miaſmata & effluvia peſtilentialia abarcere. Hucusque Excel. Medicus Moraviæ.

An

An Essay of the POROUSNESS OF SOLID BODIES.

CHAP. I

AS 'twill with far less difficulty be allowed, that Animals and Vegetables, and such Bodies, as have belonged to either, abound with Pores, than that Inanimate, Solid, and even Ponderous Bodies are not destitute of them: So 'tis far less difficult to make out the former than the latter of these Propositions.

sitions. And therefore, *Pyrophilus*, I hope you will not expect that I should give you as many proofs of the one, as I have of the other; however I despair not, that those I shall present you, will appear sufficient for my purpose, though they be not numerous enough to make me careful to marshal them in any exact order.

Of the reasons that induce me to think that even Solid Bodies are not destitute of Pores, there are *some* that have a greater Affinity with those arguments that the Schools are wont to call *à priori*, because they require more unobvious Ratiocinations upon Physical Principles, and *others* which resemble, and indeed are, such proofs as are usually named *à posteriori*, being suggested by the *Phænomena* afforded us by experience, without the help of any difficult Ratiocinations.

Of the First sort of Reasons I shall propose to you three; and begin with that, which may be drawn from the Origine and Formation of divers hard Bodies.

Bodies. For I have elſe-
where endeavour o
and I hope not unſu
ceſsfully, to ſhew, both
that divers ſtones, and
even Gems themſelves,

See the Tract of the Origine and Vertues of Gems, and the Notes about the Mechanical production of Hardneſs.

and that ſeveral Metalline and other Mineral Bodies, were once either viſible Liquors or at leaſt very ſoft ſubſtances. And I have elſewhere proved, that both theſe kinds of Bodies do conſiſt of, (which is the caſe of Liquors) or abound in (which is the caſe of ſoft and moiſt Bodies) minute particles of determinate Sizes and Shapes; from whence I think one may very probably conclude, that ſuch Gems and other Mineral Bodies, notwithſtanding any hardneſs they afterwards come to acquire, are not deſtitute of Pores, ſince 'tis no way likely, that Corpuſcles of various and very irregular Figures, ſuch as thoſe of moſt Liquors of the terreſtrial Globe are wont to be, can be ſo brought together, eſpecially by chance, cold, or any other ſuch agents, as not to intercept little Intervals or Pores between them.

CHAP. II.

ANother thing which makes me think the Porosity of the most part even of Solid Bodies to be great, is the consideration of the great disparity, that may be found in the specifick Gravities of such Bodies, as the Eye does not perceive to be Porous. For, *though* Water be a Body of that kind, and though its parts be so close packt together, that the attempts of Ingenious men, to make a manifest compression of that Liquor by outward violence, have not hitherto proved successful, *yet* we find, that stones, Clays, metals, and even some Woods and a multitude of other kinds of Solids, will readily sink in Water, and by consequence are specifically heavyer than it; which greater gravity seems not any way explicable, without supposing, or at least so well as by supposing, that the Corpuscles whereof such

ſuch ſinking Bodies conſiſt, do either lye cloſer together, or are ſeparately more ſolid, than thoſe of Water; which Liquor muſt conſequently be Porous, though neither the Eye, nor the great force that has been ſeveral ways employed to compreſs it, can diſcover any Pores in it. Upon the ſame ground I further conclude, that ſolid Stones themſelves, as Marble, Flints, *&c.* Are not free from Poroſity. For whereas, as far as ſeveral Tryals purpoſely made can inform me, I have found, that ſuch of theſe as have nothing metalline in them do ſeldom or never reach to treble the weight of an equal bulk of Water, they will, upon the former grounds, appear to be conſiderably Porous; ſince the lighteſt metals, which are Tin and Iron, are above twice heavier *in ſpecie*, that is, the bulks being equal, than Marble, Flints, Chryſtal, *&c.* And by the ſame reaſon I alſo infer the great Poroſity, even of the Solid Body of Iron, which is as well heavier, as very much harder, than Tinn. For though

Copper be a good deal more ponderous than Iron, or Steel, yet I have divers times found fine Gold, to be more than twice as heavy *in specie* as Copper, since, whereas this Metal, whether it be *European*, or brought from *Japan* (for of that also I made Tryal) is about nine times as heavy as so much Water; I found refined Gold to be about nineteen times as heavy as Water equal to it in bulk. By which it seems highly probable, that so solid and heavy a Body, as Iron or Steel it self, may be so porous, that Metalline matter equal to it in weight may naturally be contained in much less than half the Dimensions that Metal possesses. And that Gold it self, which is the most compact and solid Body we know of, is not destitute of Pores, may appear by the Dissolution of it in Quick-Silver, of which I shall speak a little below. And if any should pretend, that hardness may be a greater argument of the Compactness of a Body, and its immunity from Pores, than its specifick weight can be; I

shall

ſhall add, that though I have found that *Emery*, which is the Body employed to cut ſteel and Load-ſtones and Cryſtal, and the moſt of Gems, being indeed much harder than Marble or Flints, be far heavier than thrice its bulk of Water; *yet* that ponderouſneſs proceeds, as I elſe where intimate, from the mixture of a metalline Subſtance, which I have ſeparated from it. And Diamonds, though much harder Bodies than *Emery*, and indeed the hardeſt we know of in nature, are ſo far from being, as ſome of late have written, the moſt ponderous of Bodies, that having examined them hydroſtatically, by a way elſewhere mentioned, I found them not much heavier than either Cryſtal, or fine Glaſs, and not half ſo heavy as the lighteſt Metals.

CHAP. III.

THE next thing, from which the Porousness of Solid Bodies, and even those that belong to the Mineral Kingdom (as the Chymists speak) may be deduced, is the same with the first of those from which we formerly argued the Porosity of Substances belonging to the Animal Kingdom, namely, the very frame & constitution of such Bodies. For the solidest Bodies themselves, resulting from the Convention or Coalition of a great number of Particles of several bignesses and shapes, we cannot reasonably suppose, (especially in those concretes wherein they are not ranged by a seminal Principle) that they should be contexed so, as to touch one another exactly every where and therefore they must of necessity leave some little Intervals and Pores between them.

This

This reaſon will, I hope, appear clear enough of it ſelf, to him that ſhall attentively conſider it, eſpecially if he know, that it has been Geometrically demonſtrated, that there are but very few figures that will, (as they ſpeak) *implere ſpatium*, that is, which being adjuſted to one another will ſo exactly touch, that there is not the leaſt unfilled ſpace within the circumference or circuit, if the figures be plain, or within the ambient *Superficies*, if they be ſolid; ſo that, conſidering the vaſt variety of other Figures, which made *Epicurus* and other *Atomiſts* pronounce it *incomprehenſible*, 'tis very obvious to conceive, that Corpuſcles of ſuch differing ſhapes being put together, will leave multitudes of little Pores intercepted, between thoſe parts that do not every where touch one another. And even the Mathematical Figures lately ſpoken of, may be ſaid to fill ſpace rather in a *Geometrical* than a *Phyſical* ſenſe. For, if ſuch Portions of matter as are required to conſtitute, for inſtance, a Cube,

were actually put together, they would not exactly fill the space comprehended within the ambient surface of the Body they compose, because the component Bodies, being Physical, consist of Corpuscles of their own particular shapes, which we never find Mathematically exquisite. As if, for example, the Cube were of Marble, no Art could polish the sides of a component Body so, as that they should be perfectly smoothed since (as, if I mistake not, the learned *Gassendus* well observes) Emery, Pumice-stone, and even Puttee, or other Powders that are employed to polish them, do themselves consist of little hard angular Corpuscles, that leave small scratches, like so many little furrows, on their surfaces, which must needs hinder the perfect contact of the whole surfaces of two contiguous Bodies, and consequently leave here and there Intervals or Pores, between those surfaces; to which I shall add that Marble it self as 'tis Marble, abounds with internal Pores, as will ere long appear by Expe-

Experience, and as may be rationally conjectured from the Specifick Levity of it, in compariſon of Gold and Lead.

CHAP. IV.

HAving diſpatched the Arguments *à priori*, that may be imployed to ſhew the Porouſneſs of Solid Bodies, 'twill be now ſeaſonable to propoſe ſome Experiments and obſervations, that may (as 'twere) *à poſteriori* either evince or confirm the ſame Doctrine.

Of theſe Inſtances ſome relate to Solid Bodies that are of leſs ſpecifick gravity ſome to Foſſiles preſumed to be devoid of Metalline parts, ſome to Minerals that are thought to participate of a Metalline nature, ſome to Metals themſelves, and ſome to Glaſs.

To begin with the firſt ſort of theſe Inſtances; That Wood is Porous, there are many things that argue; ſome of which are elſewhere mentioned. But few would ſuſpect, that Quick-Silver which is ſo unapt to enter the Pores

of

of Bodies much leſs compact, ſhould permeate peices of Wood of a conſiderable thickneſs; and yet, that we have made it do by the following Experiment. We took a wooden Trunk, ſuch as is employed to ſhoot pellets at Birds, with ſtrength enough to kill them, and having cloſely ſtopt one end of it, we poured in Quick Silver at the other, till it reached to a good height in the cylindrical Cavity of the Inſtrument, and then the lower parts of the Metalline Liquor, being aſſiſted by the weight of the Incumbent ones, (not to mention that of the Air) to preſs into the Pores of the Wood, they iſſued out at them on all ſides, in great numbers of minute drops, much after the manner of Quick-Silver ſtrained through Leather, out of amalgams; which was a *Phænomenon* not unpleaſant to behold. But till I have opportunity to repeat this Experiment with differing circumſtances, I ſhall not think it fit to lay much ſtreſs upon it, for want of knowing, what intereſt the great weight of the Quick Silver may have had in the event. And

And this caution may perchance be applicable to the following Experiment, namely, that having, by the help of my Pneumatical Engine, withdrawn the Air from one ſide of a round peice of board, the Air on the oppoſite ſide, not having its preſſure any longer reſiſted by that which it uſed to meet with from the withdrawn Air, preſſed ſo ſtrongly againſt the ſurface of the Wood expoſed to it, as to make it ſelf way through the Pores of it, and get copiouſly enough into the Cavity whence the other Air had been pumpt out; (the weight of the incumbent Atmoſphere doing on this occaſion, what the weight of the Quick-Silver did on that laſt recited:) Which was a ſurprizing ſpectacle to the by-ſtanders becauſe the board that was thus permeated, was of ſtrong Wood, and of conſiderable thickneſs.

I ſhould here ſubjoin ſeveral other Arguments of the Porouſneſs of Wood, if I could diſplay them without more words, than I am willing to allow them; and

and I presume it may here suffice, if I let you see by some surprizing Effects that when Wood is reduced to that thinness, that its closeness or Porosity may conveniently be examined, it will easily enough give passage, even unto visible, odorable, and tinging Corpuscles though they invade it not in the form of a Liquor, but of dry Exhalations, so they be not incommensurate to its Pores. This I suppose, you will not scruple to infer from the following Tryals, as they were long since set down in one of my Note-Books.

1. The Fumes of our smoaking Liquor [described in the foregoing Essay] tinged a Copper half penny, through a broad thin shaving of Dale, that did not, when held against the window, discover any perforation; tinged it, I say, very deeply in about a quarter of a minute and somewhat less.

2. The same Fumes tinged manifestly, but not so notably, the same half penny first cleansed through two such shavings of Dale, laid one upon another

another in ſomwhat leſs than one minute.

3. And in about one minute the ſame Fumes tinged the cleanſed half penny, through three ſuch ſhavings of Dale very viſibly, but not ſo conſpicuouſly, as through the two forementioned. Theſe Tryals were made without the help of heat to promote the operation of the Fumes.

CHAP. V.

FRom the conſideration of Woods let us now proceed to give ſome Inſtances of the Porouſneſs of Bodies made of cloſe and compacted, and perhaps well baked Clays or other Earths.

That Earthen Veſſels, thô ſtrong and well bak'd, are many of them porous enough may be argued not only from what has been lately recited, but from hence, that ſome of them will ſuffer themſelves to be ſoakt

soakt through by Oyl. Others by solutions of Nitre, and some other Salts. And there are very few of them, without excepting *Hassian* Crucibles themselves, that will long keep Salt of Tartar, and such like fixt Alcalies, in fusion without being penetrated by them. I have heard Distillers complain, that when they have distilled corrosive materials, as Vitriol and Salt-Petre, with strong fires, in those Earthen Vessels that are commonly made use of in *London* (especially by refiners) instead of Retorts though their necks be strait and long (upon which account they are called long-necks) a considerable quantity of the finest Spirits make their escape quite thorow the Vessel; so that in the Retort and Receiver many ounces are found wanting, of the first weight of the matter to be distilled. And this sometimes, when the Vitriol has been previously calcin'd, and a reasonable allowance has been made, for what may have escaped thorow the Lute, that joined together the long Neck and Receiver.

And

And *though* I have obſerved of our Bottles, made of the ſame Earth with Juggs, that they are hard enough to ſtrike Fire with a good Steel, *yet* a good Experimenter upon ſuch Veſſels of whom I made enquiry, has aſſured me that theſe, as compact as they are, may, even without external heat, have their Pores pervaded by the finer parts of Spirituous Liquors.

To this purpoſe I remember that meeting once with a *Virtuoſo*, that was curious about the ways of making Sider as brisk and ſpirituous a Liquor as he could; I enquired of him, whether he was able to keep in the ſubtil Spirit of this Skilfully fermented Liquor, in thoſe earthen Bottles, that, by reaſon of the ſolidity they acquire by the vehement coction of the Fire, are commonly called *ſtone Bottles*; to which he replyed. that he often found to his trouble, that the Liquor would permeate the compact Subſtance of the Bottles: And when I objected that the Spirits might either eſcape out at the Cork, which I have made ſeveral Spi-

rits

rits of divers kinds that would readily permeate; he replyed, that what he had ſaid appeared by the outſide of the Bottles: To which when I further objected, that the ſight of dew on the ſurface of the Bottles, would not convince me, without taſting whether it were vinous, becauſe I had divers times obſerved, that brisk Liquors would produce a dew, on the outſide of the Veſſels that contained them, not by any tranſudation (for I have made Tryal of it in Glaſſes) but by condenſing the aqueous vapors, diſperſed through the neighbouring part of the Ambient Air: He replyed that, beſides what his taſt had informed him of the quality of this dew, he found that the included Liquor, though exactly ſtopt, waſted in not very many Months ſo conſiderably, as ſometimes to loſe a ſixth, or even a fifth part; & this eſcape or percolation of the Liquor through the Subſtance of the Veſſels, he affirmed himſelf to have obſerved, not only in one or two Bottles, but in very many and the like obſervation for the main

main was confirmed to me, upon his own experience, by an eminent Physician, who, being a great Lover of brisk Sider, used to bottle it up early and carefully.

Though good *Hassian* Crucibles be very closely compacted, as well as throughly baked Bodies, and upon that account are able to keep Silver and divers other Metals long in fusion, without letting them at all run out; *yet* having dissolved Silver in *Aqua fortis*, I observed that, *though* the Salts were by this operation so chang'd that this horn-like Silver did dissolve neither in the *Aqua fortis*, nor in the *Aqua Regia* that I put it into; *yet* when I kept it a while in fusion, (which 'tis easily brought to be) among quick Coals, it would without cracking or perforating the Crucible, soak into it, and permeate the Pores of it, in I know not how many places, as I convinced some curious persons, by shewing them on the outside of the Vessel, a multitude of minute globules of pure Silver, like so many little drops, that

were got thither, as it were, by transudation.

CHAP. VI.

FRom baked Earths, that are designed in point of hardness to emulate stones, we will proceed to give some instances of the Porousness of Natural Stones themselves.

There goes a tradition, that in some part of the *West Indies* they have a Stone, of which they make large Vessels, wherein they put Water to percolate, as it were, through a strainer. Of these Vessels I had one sent me for a present, whereof being hereafter to give some account in a more opportune place, I shall now only take notice that I found that Water would (thô slowly) soak through the Vessel, thô it were considerably thick.

If, as many of the Ancients, and most

moſt of the modern Corpuſcular Philoſophers have conceived, the Tranſparency and Opacity of Bodies proceeds from a Rectitude or Crookedneſs of Pores, which makes them fit or unfit to transmit the Light, that tends to pervade them in Phyſically ſtraight Lines: If this *Hypotheſis*, I ſay, be allowed, we may draw a very probable argument, that Stones may be Porous, from the *Phænomena* of that odd Gem, that is beſt known by the name of *Oculus Mundi*. For this ſmall ſtone (at leaſt that which I made my Obſervations of) when 'tis dry, and is kept in the Air, is opacous, almoſt like a poliſhed piece of white Amber, and ſo it continues, as long as 'tis kept dry. But if you put it into fair water, it will in no long time, become by degrees quite Tranſparent, and that which I made Tryal of looked then not unlike a piece of clear yellow Amber which by degrees does in the free Air loſe its Tranſparency and turn to be opacous as before. Now according to the above mentioned

Corpuscular *Hypothesis*, the Pellucidness which the Stone acquires in Water, may be accounted for, by saying, that the Liquor getting in at the crooked Pores of the Stone, does for the time rectify them, and make them pervious to the straight Beams of Light; as we see that White Paper, being wetted with Water, or, which does far better, being made to imbibe Oyl, has its Pores so changed and rectified, that the Water much lessens its Opacity, and makes it almost Semidiaphanous and the Oyl, if it be fine and well soaked up, makes it Transparent. But upon the recess or evaporation of the imbibed Particles of Water, the Pores of the little Stone becoming crooked again reflect the Rays of light they should transmit. Which explication will be the better allowed of, if my memory do not misinform me, when it tells me, that a learned Member of the Royal Society found the *Oculus Mundi* to weigh more in a nice ballance, when it was taken out of the Water and well wiped, than before

fore it was put in. This Stone, which very few of the writers about Gems take notice of, is ſo rare and difficult to be got, that I had not opportunity to make upon it all the Tryals I deſired; and therefore, though the Subject be curious, I may, I hope, be excuſed, if I haſten from it to another.

There is ſo much difference in many Qualities betwixt Stones and Metals, that 'tis very probable, that when the Corpuſcles of both come to be brought together into one Maſs, they will not touch one another ſo cloſe, as not to leave ſtore of little Intervals or Pores between them. And upon this ground I have been apt to think that divers very hard Stones, Diaphanous and Opacous, are not devoid of Poroſity. For I have elſewhere delivered a way by which I have obtained good ſtore of Metalline parts, both from American *Granats*, and from *Emery*; though this laſt be ſo exceeding hard a Stone, that 'tis uſually imployed by artificers to work upon

Iron and Steel, and to cut not only *Rock Cryſtal*, but divers Gems that are harder than either that or Steel.

Upon the ſame ground one may probably infer the Porosity of many Artificial Gems made by Fuſion; for to give theſe the colour of Sapphirs, Topazes, Amethyſts, &c. we are wont to add to the vitrifiable matter, either ſome prepared metal, as calcined Copper, *calx* of Gold, &c. or elſe ſome Mineral as *Zaffora* and *Manganeze* (as the Glaſs-men call *Magneſia*) that abounds in Metalline parts. Nay I remember, I have ſometimes given the colour to the vitrified ſubſtance, by imploying natural Gems, as Granats; though to ſhew that the coloration which the maſs received from theſe, proceeded from the Metalline Corpuſcles, that lay hid in the tinging matter, the Colour produced was not that which was conſpicuous in the Gem it ſelf, but one very different from it, and ſuch as the metal, which upon other accounts I ſuppoſed the Gem to partake of, ought, according to the Grounds

Grounds I proceeded upon, to produce in the vitrifiable matter. And this very Experiment makes it alſo highly probable, that even natural tranſparent Gems, (divers of which are much harder than Marble, Iron & even Steel) are themſelves Porous; ſince, notwithſtanding their Tranſparency and ſeeming Homogeneity. They are made up of Ingredients of ſuch differing natures as are Stony and Metalline Corpuſcles.

From the ſame Ground we may likewiſe deduce the Porosity of Marcaſites; many of which I have obſerved to be, not only hard enough, plentifully to ſtrike fire by collision with Steel, but more ponderous than even divers Oars, that were rich enough in Metal, to be wrought with good profit. And yet theſe hard and heavy (Mineral) Stones are very far from being homogeneous; ſince I have met with few Inanimate Bodies, produced by Nature her ſelf, ſo compounded as ſeveral Marcaſites that I have ſeen. For theſe are wont to con-

tain more or less Copper, and Iron too: and they abound in Combustible Sulphur, a Corrosive Salt, and a certain Fixt Substance, which I found to differ from true Earth, but of whose Nature the Tryals I have hitherto made on it, have but little satisfied me.

I might here deduce the Porosity of the Load-stone, as hard and solid a Body as it is, partly from the *Effluvia* it emits and admits, and partly from the Heterogeneity I have by Chymical Tryals found to be in it. But these things belong more properly to a Paper about Magnetical Bodies, for which I the more willingly reserve them, because other Experiments will keep them from being needful to be here insisted on.

The Porosity of Marble, and divers other Stones of like Contexture, may with probability be deduc'd from this, that they are liable to be dissolved by divers of the corrosive *Menstruums* of the Chymists, such as *Aqua fortis* sp. of Salt, *&c.* And some of them even by Vegetable Liquors, of Natures own preparing

preparing, as the juice of Limons, and that of Barberries. But a more noble and ſatisfactory inſtance may be afforded, by the invention of ſtaining or colouring white Marble, without imploying any fretting Liquor, or ſpoiling the Texture of it. This way being caſually lighted on by an ingenious Stone-cutter in *Oxford*, who gained by it both credit and money, he long ſince thought fit to acquaint me with it, upon condition of ſecreſy (which I have to this day inviolably kept) and of my aſſiſting him to improve his Invention by making it practicable with other Colours than Red. Theſe circumſtances I mention, to ſignify that I write not by gueſs, of this matter, having both ſeen the Experiment tried, and made it my ſelf. But though I found it far leſs improvable to other uſes, then one would expect, yet, as to our preſent purpoſe, it is very appoſite. For by this way an excellent red Colour, may be made to ſoak into a piece of White Marble, almoſt as Oyl will do in o Leather, without impairing,

impairing, that I obſerved, the ſolidity of the ſtone, which, after being dyed, will be capable of a fine gloſs as before. Some other Colours (yet but few fair ones) would by this way be brought to ſoak into Marble, on which one may with them ſo define, and limit the Colorations, that I remember the Artificer, when I brought him to kiſs the Kings hand, preſented His Majeſty with an *Andromeda*, whoſe Colours were ſo vivid, that this skilful Judge of curious things, was pleaſed to honour it with a place among his Rarities. And, to ſatisfy his Majeſty that the fine Red was not, as ſome ſuſpected, a mere varniſh, I purpoſely broke a plate of Marble, in whoſe fragments he ſaw, that the Pigment had ſunk to a conſiderable depth, into the very Subſtance of the Stone. And I doubt not but it might have been made eaſily enough to ſink much deeper, if it had been thought neceſſary. A fine Plate of ſuch White Marble, with the penetrating Pictures of Coloured Flowers drawn upon it I

yet

yet keep by me to ſatisfy the curious. And ſome Utenſils, as Hafts of Knives, Salt-Sellers, *&c.* I have known to have laſted ſeveral years.

There is an Experiment that ſeems much ſtronger for the Porouſneſs of Solid Bodies, than that it ſelf (which was lately recited) of ſtaining Marble. For in *Italy* ſome Goldſmiths have a way of imbuing Fragments of Rock-Cryſtal, which is a Body much harder than Marble, with divers Colours; which do ſometimes ſo imbelliſh them, that having ground off thoſe parts that would not receive the ſame Tincture, they ſet ſome of them in Gold Rings, and ſell them with profit. When I was inform'd of this, I thought of a Compoſition, that I hop'd might perform the ſame thing, and perhaps better than that which was employ'd by them, who either knew not, or for ought I could perceive, us'd not, ſome Minerals that I thought fit for the purpoſe. Upon this Preſumption we carefully cemented ſome clear Fragments of Native Cryſtal with a Compoſition

Compoſition of ſome Volatile Minerals, together with a Salt or two, and having ſuffered the Crucibles to cool leiſurely, we had divers of the Fragments ſtain'd here and there, ſome with one Colour and ſome with another, as differing Fumes happen'd to invade them. And of theſe Colours ſome were dark or dull, and ſome vivid enough. But having conſider'd the ſtain'd pieces, and the progreſs of the Operation, more attentively, I began to doubt, whether theſe Adventitious Colours were really produced by the bare penetrating of the Mineral Fumes into the Pores of the Cryſtal it ſelf. For I thought it poſſible, and not very unprobable, that the great Heat of the Fire, and the Ambient Mixture, might cleave or flaw in many places ſome of the Cryſtalline Fragments; and that the finer parts of the Minerals being vehemently agitated, might inſinuate themſelves into theſe thin Flaws, which upon the ſlow refrigeration of the Stones, ſhutting themſelves cloſe again, might lock

lock up the tinging Particles, without appearing discontinued, especially to the Eyes of Persons that were not made use of with a more than ordinary attention, excited by distrust. This suspicion was not removed by the apparent entireness of each little piece of Crystal. For having taken more than once a Lump of that stone, and slowly brought it to be red hot in the Fire, I found that if I warily quenched it in Water, though it would thereby acquire a multitude of little cracks or Flaws, which destroyed its former transparency, and made it look whitish, yet it continued still an entire Body, notwithstanding the disadvantageous haste, wherewith the operation had been performed. And having after this suspicion, inquired of an ingenious Lapidary, that belonged to a great Prince whether in polishing of Gems upon the Wheel, he had taken notice that the Heat would slaw them, he answered me, that now and then he had observed that some Stones, especially. if I misremember not, Rubies, when they

they were very much heated by the swift motion of the Engine he employed to polish them, did cleave as it seemed to him, and gape, so as at first to make him fear the Stones were spoiled; and yet afterwards they closed so perfectly, that no Flaw at all could be perceived in them. I have mentioned the foregoing Experiment of tinging Crystal, to comply with the dictates of Philosophical candor, which forbids me to lay much stress upon a Proof, whose validity I my self distrust. But perhaps my suspicion may by further Tryal, which I have not now convenience to make, appear not to have been well grounded, and in that case the tinging of Crystal, as well inwardly as outwardly, by Fumes will be a noble Argument for the Porosity of Solid Bodies, Rock-Crystal being harder, and probably closer, not only than Marble, but even than Glass.

CHAP.

CHAP. VII.

THat Metals, though the heavieſt of Bodies, are not deſtitute of Pores, may be with probability proved in a general way by this; That they are all diſſoluble in their appropriate *Menſtruums*, as Gold in *Aqua Regia*, and all the reſt in *Aqua Fortis*, except Tin, which yet it ſelf will be corroded by that *Menſtruum*, though not well kept up in a fluid form, as it may be by another *Menſtruum*, which I elſewhere teach; and ſometimes the ſame Metal may be diſſolved by very differing *Menſtruums*, as Lead by *Aqua fortis*, and Spirit of Vinegar; and Copper by *Aqua fortis*, *Aqua Regia*, Spirit of Vinegar, Spirit of Salt, and ſome other Solvents, that upon Trial I have found ſufficient for that purpoſe.

But 'twill, I preſume, be thought more conſiderable to my preſent argument, if it be ſhewn, that Bodies that appear Groſs, and which in their Natural ſtate are not fluid, and are confeſſed

confeſſed to be of a compounded nature, will penetrate Metals quite through, even without melting them.

This we have divers times effected by a Cementation of Copper Plates, With common ♀ (much a kin to a way preſcribed by ſome Alchymiſts to make *Vitriolum Veneris*) which we warily performed much after this manner. We took good Copper laminated to the thickneſs of a Shilling or thereabouts, and having cut it into ſmall pieces, that they might the more eaſily be put into a Crucible or Cementing Pot, we ſtrewed at the bottom of the Veſſel ſome beaten ♀, and then covered it pretty well with ſome of theſe Plates, which were laid on flat-wiſe. Upon theſe we ſtrewed another Bed of powdered Brimſtone, and cover'd that alſo with Plates, upon which we put more Sulphur, & ſo continu'd making one lair of Brimſtone, & another of Metal, till we had employed all our Plates, or filled the Crucible, being careful that the uppermoſt Bed, as well as the loweſt, ſhould be of Sulphur.

phur. This done, we luted on an earthen Cover to the Veſſel, to keep the ♃ from taking Fire, and afterwards having placed the Pot amongſt Coals kindled at a good diſtance from it, that it might be heated by degrees, we kept it for ſome few hours (perhaps Two or Three) in ſuch a degree of Fire as was ſufficient to keep the Sulphur melted (which is eaſily enough done) without bringing the Metal to fuſion; the Pot being cold, we took off the cover, and found the Plates quite altered in Colour and Texture, ſome of them having a dark and dirty Colour, whilſt others looked of a fine Violet or Blew; they were generally ſo brittle, that 'twas very eaſy to break them with ones finger, and reduce them to Powder. And (now to add ſuch Circumſtances as a Chymiſt would not take notice of) many of the Plates, when they were broken, appeared to have been (by the contiguous Beds of Sulphur above and below) horizontally divided each of them into two

Plates, divers of which in ſome places had a manifeſt diſtance or Cavity between them. And 'twas obſervable, that when I conſidered one or other of theſe Plates attentively in the parts that had been contiguous before I broke it, I could plainly diſcern a multitude as 'twere of Fibres, reaching from one of the flat ſides of the Plate to the other, & running many of them, as to ſenſe, parallel to one another. Theſe Circumſtances may ſufficiently argue, that the Plates were pierced quite through by the Brimſtone; but for confirmation of this, and to ſhew too that the Sulphur does as it were ſoak into the Body of the Metal, and in a Groſs manner lodge it ſelf there; I ſhall add, that not only to the Eye the Plates appeared much ſwelled, or thicker then when they were put in, but having weighed them before the operation was begun, and after it was quite ended, the Copper, though it needed not to be freed from externally adhering Sulphur, was found to have a conſiderable increaſe of weight by the

the acceſſion of the Sulphur, which (to add that circumſtance) though it appeared not to the Eye, yet if a Plate were laid upon quick Coles, and blown, would oftentimes diſcover it ſelf by a Blew flame.

By making the like Experiment for the main, we found that refined Silver, though a more heavy and compact Body, than Copper, and not diſſoluble by moſt of the *Menſtruums*, that work on this Metal, is penetrable by the Body of Sulphur, which will alſo calcine Tin and Lead and (eſpecially) Iron.

Nor is Sulphur the only conſiſtent Body that has this ingreſs into Metals; for we have found them penetrable by prepared Arſenick. But becauſe theſe operations are not ſo eaſy, and the Subject is not eaſily handled without danger, I forbear the mention of them in this place, where, after what has been recited, it is not neceſſary.

Another Experiment there is,

which does more advantageously than that made with Brimstone, discover the Porosity of Copper. For there is a way by which, without the help of Salts, Sulphur or Arsenick, one may make a solid and heavy Body soak into the Pores of that Metal, and give it a durable Colour. I shall not mention the way, because of the bad use that may be made of it. But having had the curiosity more than once to try it upon a new Copper Farthing, the event was, that one part of it, which I purposely forbore to tinge, remained common Copper still, but the other part acquired a yellow, that differed very little, if at all, from a Golden Colour, the former stamp that was impressed upon the coin continuing visible. And to convince the scrupulous, that the Pigment did really sink, and as it were soak into the Body of the Metal, and did not meerly colour the *Superficies*, I made them take notice, that the Farthing was not melted, and yet by filing off a wide gap from the Edge of the Coin, inwards, it plainly appeared,

appeared, that the Yellow or Golden Colour had penetrated a pretty way beneath the ſurface of the Farthing; ſo that it looked there as if two thin Plates, the one Yellow, and the other Reddiſh, did, without any Interval between them, lye upon one another.

If Bodies be not to be pervaded, or deeply pierced into, by Corpuſcles, but only to have their more ſuperficial Pores, if I may ſo call them, penetrated thereby, 'tis poſſible that Bodies, which are either much harder, or much cloſer, than Marble, Alabaſter or the like Bodies, may have their Pores poſſeſſed even by odorous Corpuſcles; I ſay, *even by ſuch*, becauſe they are moſt of them groſs enough to be kept from exhaling, by Bodies much leſs compact then Earthen Bottles; and are far from being of the fineſt particles that Nature affords. But that ſuch odorous Corpuſcles may lodge themſelves in the exterior Pores of very cloſe Bodies, I have been inclined to think, *not only*, by the obſtinately

adhering Odour, which I found by Tryal, that ſome ſuttle and Spirituous parts, ſuch as the Chymiſts would perhaps call in their Aggregates, the Eſſence of Musk, Amber, Ambergreece, *&c.* notwithſtanding the waſhing of the Glaſſes, that had long contained ſuch Liquors; but by what has been aſſured me by a Phyſician of great Experience, who travelled and lived much in the Eaſt. For having told him, that I had been informed, that in ſome places leſs famous then *Damaſcus*, for curioſity in making fine Sword blades, there was a way found and practiſed of making them richly ſcented, without injury to their Gloſs; I deſired to know of him, if at *Damaſcus*, or elſewhere, he had ſeen any of them; to which he replied, that he did not remember he had, but yet made no doubt the Information might be true. For he himſelf had in *Europe*, and kept for divers years, a Watch, whoſe Metalline Caſe, was richly perfumed; and when I askt him, whether there were not ſome thin

thin varniſh, or ſome outward Caſe of perfumed Leather, or Chagran, or ſomewhat elſe, from whence the odour proceeded, he aſſured me, that his obſervations had prevented and removed that and divers other Scruples, and that the caſe being clean and Gloſſy, he could not perceive that the Odour proceeded from any thing elſe, than ſome odoriferous thing, or other that was inviſibly lodged in the Pores, or Porous Subſtance of the metal it ſelf. And indeed, ſince both Arſenick, and even common Sulphur, may by Art be as it were incorporated with ſome Metalls, and even with Silver, I ſee not why it ſhould be impoſſible, that ſome pleaſingly ſcented Subſtances ſhould be admitted into the Pores of Metalline Bodies, and be volatile enough to have their ſubtiler parts fly off in odorous Exhalations, eſpecially if they be a little excited, as the Watch Caſe lately mentioned was, by a gentle heat, ſuch as was that of the

wearers pocket. And on this occasion I remember to have made a certain Metalline composition, which looked like Gold, and of which I caused a Ring to be cast, and yet this Metal retained so many unperceived Mercurial Corpuscles in it, that an Ingenious Person to whom I discovered the composition of it, found after Tryal, as he assured me, that being worn as a Ring, it had in some distempers, particularly of the Eyes, manifest operations, that evidently enough seemed to flow, at least in great part, from its participation of the Mercury we employed in preparing the Factitious Metal.

Since the writing of the former part of this Essay, having met with an inquisitive Nobleman, who had lived in several parts of *Africk*, and was Governour of the best Town the *Europeans* have on that Continent, I discoursed with him, among other things, about the Skill that some ascribe to the *African Moors*, of making excellent weapons, whereof I knew his excellency

cellency was very curious. Upon which occaſion he told me, that ſome of the Off-Spring of the *Granadine Moors* were indeed the beſt at making Arms that ever he met with; and that he had ſeen ſome weapons of their forging and tempering, that he preferred even to thoſe of *Damaſco.* And when I asked him whether any of them had the art of perfuming their Weapons, he anſwered me, that ſome of them did it admirably well, and inſtanced in a Blade which he kept for ſome years, & found it ſtill to retain the perfumed ſcent, which he ſuppoſed to be as it were incorporated with the Steel whereof the Blade was made. When I told him, I ſuſpected that the ſcabbard might have been well perfumed, and communicate its odour to the contained Blade, he allowed the objection to be plauſible, but replyed, that it was not concluding, ſince miſliking the Scabbard, as not handſom & faſhionable enough, he cauſed a new one to be made, wherein he afterwards kept it. And the ſame Lord further told

told me, that he had alſo a Fowling Piece, whoſe Barrel was perfumed. And when I objected that perhaps the odoriferous ſcent proceeded from the ſtock, and not from the Metal, he anſwered that the Gun not being, when it came into his poſſeſſion, skilfully and handſomely mounted, he cauſed the Barrel to be fitted with a new ſtock, notwithſtanding which, it continued to ſmell fragrantly. And when I further asked, whether he ever cauſed the Gun to be waſhed or ſcoured after it was grown foul by having been often ſhot in, he anſwered me, that he had, and, as far as I can remember, ſubjoyned, that after it was made clean it did (notwithſtanding the ill ſcent that the ſoot of the Powder had given it) retain a pleaſing ſmell, but fainter than before.

CHAP.

CHAP. VIII.

SInce the Subject of this Eſſay is the *Porouſneſs of Solid Bodies*, and ſince there is no Body that is generally reputed ſo cloſe and compact as Glaſs, it will be pertinent to this diſcourſe, and probably will be expected, that I ſhould here ſay ſomething about the Queſtion, whether Glaſs be, or be not, devoid of Pores.

But before I acquaint you with my Tryals, or my thoughts, about this Problem, I think it requiſite to clear the ſenſe, in which I mean to handle it, that I may not, as ſome others have done, for want of diſtinctly ſtating the Queſtion, ſpeak confuſedly and erroneouſly of it.

I ſhall then here obſerve, to prevent miſtakes, that the Poroſity of Glaſs may admit of two Acceptions. For it may be ſaid to be quite pervious to Fluids,

Fluids, as a Boot is to Water, or only to be capable of having its ſuperficial parts further and further diſſolved or corroded thereby, as a Silver Cup is Porous in reference to *Aqua fortis*, which cannot ſweat through it, as Water does through a Boot, but eat its way through it, by diſſolving the Texture of the Veſſel.

Another thing requiſite to be premiſed, to prevent Ambiguity, is, that Glaſs it ſelf is not all of one ſort, as men unacquainted with Chymiſtry are wont to preſume, for Glaſs of Antimony, for inſtance, and that of Lead, both of them made *per ſe*, do manifeſtly differ, uſually in colour, and conſtantly in weight, and alſo in their operations upon Humane Bodies; and both theſe ſorts of Glaſs do in ſeveral points differ from *common Glaſs*, under which name, for brevities ſake, I comprehend both White or Cryſtalline Glaſs, as 'tis called in the Shops, and that courſer ſort, which they uſually call Green Glaſs; both which ſorts I here conſider under one Notion, becauſe

cauſe both are made of fixt Alcalies, and other fit Ingredients, as Sand, Earth, Aſhes, Pebbles, or Flints, Colliquated by a ſtrong & laſting operation of the Fire: and 'tis of this common Glaſs, in the ſenſe now declared, that I ſhall conſider the Poroſity in the remaining part of this Eſſay. In which to proceed with ſome Method, I ſhall digeſt what I have to ſay into the enſuing Propoſitions, and the obſervations annext to them.

Prop 1. *'Tis very probable, that Glaſs may be pierced into to ſome diſtance, even by viſible and tangible Bodies.*

I know that this will ſeem a Paradox to many, and repugnant to common Experience, which ſhews that Glaſs Veſſels will contain very ſubtile and even highly corroſive Liquors, as the Spirit of Hartſhorn, of Urine, and that of Nitre; as alſo thoſe potent *Menſtruums*, as *Aqua fortis*, *Aqua Regis*, and Oil of Vitriol, which

which not only are not observed to pierce into it, but are unable to make any sensible alteration, so much as on the superficial parts, even in those Vials wherein they have been long kept.

But, notwithstanding all this, I presume you will not condemn the lately proposed Paradox, when you have considered what may be said to justifie it. For, besides that it may be made probable *à Priori*, by the Arguments whence we have formerly proved the Porousness of Solid Bodies in general; there are two sorts of Experiments, from whence one may argue, that Glass in particular is not devoid of Pores in the sense wherein we are now speaking of them.

And first, I remember, that, having kept for a good while in a vial, a quantity of a certain Spirit of Salt, that I had reserved in a cool place; I found, when I came to use it, that the Glass was crackt, and most of the Liquor was run out; but, before this happened,

happened, it had ſo far corroded the inſide of the Glaſs, that in ſome places it was eaten almoſt as thin as a piece of Paper; and this part which yet continued Glaſs, was lin'd with a much thicker white ſubſtance, that ſtuck to the ſides of it, and look-ed and taſted like a kind of odd Salt; ſo that it invited me to conjecture, that it proceeded from the ſubſtance of the Glaſs, which you know conſiſts of an *Alcali* as well as of *Sand* corroded by the Saline Spirits of the *Menſtruum*, and coagulated with them into this odd kind of Concrete; and 'twas remarkable in our veſſel, that the upper part of the vial, to which the *Menſtruum* did not reach, was not corroded, nor alter'd, tho the operation of the Liquor reached as high as the Liquor it ſelf. And I remember, that when I related all this to ſome experienced Chymiſts, one of them that was a more heedful obſerver, aſſured me, the like had once or twice, happened to him, as ſince that time it hath likewiſe done to me.

I had

I had alſo, if I miſremember not, another Vial, corroded by a diſtilled Liquor of Vitriol, that had in it more of the Phlegm than of the Oil; which you will ſomewhat the leſs wonder at, if you conſider, that ſome Corroſive *Menſtruums* will ſcarce work on ſome Bodys, if they be too well dephlegmed, or at leaſt will not corrode them ſo readily and powerfully, if they are very ſtrong, as when they are diluted with a convenient quantity of Water. And, as to Oil of Vitriol it ſelf, which is the *Menſtruum* I am ſpeaking of, when we employ it to make *Vitriolum Martis*, we are wont to weaken it with Water, that it may the better diſſolve that Metal. And perhaps you will ſuſpect, that Vitriol has ſome peculiar faculty of penetrating and fretting Glaſs, when to the Experiment newly recited I ſhall add that which follows, as I find it regiſtred among my Notes.

[A pound of *Dantzick* Vitriol and a pound of Sea Salt, after the former had been very lightly calcined, and the latter

latter decrepitated, that they might not boil in, or crack the Veſſel; we cauſed to be diſtilled in a well coated Retort by degrees of Fire, giving at length a very ſtrong one, then taking off the Veſſel, we were not much ſurprized to find, that the heat had here and there melted it, and that the fluxed *Caput Mortuum* had corroded the Glaſs, fetching off as 'twere films from it, and thoſe parts which did not appear to the Eye thus manifeſtly waſted, ſeemed yet by their great brittleneſs, to have been penetrated, ſo that their Texture was ſpoiled by the ſaline and vitriolate Corpuſcles.]

Prop II. *Common Glaſs is not ordinarily permeable by Chymical Liquors, though ſtrong and ſubtile, nor by the directly viſible or odorable Expirations of Bodies tho abſolutely ſpeaking it be pervious to ſome Corporeal Subſtances.*

This Propoſition conſiſting of two parts, we ſhall allow each of them its diſtinct Proofs.

And as for the firſt part, 'tis ma-

 niſeſtly

nifestly agreeable to the Common Experience of Chymists; who daily find, that in well stopt Vials, or at least in Hermetically seal'd Glasses, they can preserve their subtilest and most piercing *Menstruums*, as Spirit of *Nitre*, *Aqua Fortis*, Spirit of Salt, Spirit of Vinegar, and Oil of Vitriol. And this they find to be true, not only as to Acid and Corrosive Liquors, like those I have newly named, but also in those Spirits that abound with Fugitive Salts, as the Spirit of Urine, of Blood, and of *Sal-Armoniack*; and in the most subtile & highly rectified Spirit of Wine; as also in the Ethereal Oil, or, as many call it, Spirit, of Turpentine: as likewise in the Liquors of Salt of Tartar, and other fixt Alcalies resolved by *Deliquium*.

The Result of these Observations may be much confirmed by considering, how often it happens in the Destillation of more Wild and Fugitive Spirits, as of Nitre, Tartar, and Sugar; that, though they are

are much agitated, and perhaps ſubtilized, by Heat, yet, if the Lute, that joins the Receiver to the Retort be very firm & cloſe, the Receivers, though large, are often broken in pieces; which probably would not happen, if the Spirits could inſinuate & croud themſelves, through the pores of Glaſs.

But, whereas it may be pretended, that ſuch Veſſels are ſtrong and thick, I ſhall add, that I have had the Curioſity to cauſe very fine bubbles to be blown at the flame of a Lamp, purpoſly that they may be made extreamly thin, and of but a ſmall part of the thickneſs we meet with in the Veſſels made at the Glaſs houſe; and ſome of theſe I caus'd to be exactly ſtopt, and others to be Hermetically ſeal'd; but could not find, that either dry Salt of Tartar would relent in one, that was kept a good while under water, or that ſtrong Spirit of *Sal Armoniack*, which is one of the ſubtileſt Spirits that we know, would penetrate one of theſe thin films of Glaſs, which we kept

a great while immersed in it, though to discover whether it would at all penetrate the thinnest Glasses, we employed some which were of that fine sort that is called *Essence Vials*.

These and some other Tryals have, I confess, made me very diffident of the Experiments, that have been delivered by some men of Note, and built upon by others, of the Permeableness of ordinary Glass Vessels to Chymical Liquors, as, that Mercury and *Aqua fortis* being digested together in a Bolt-head may, by rubbing the outside of the Glass, be made visibly and palpably to transudate. Which Experiment (if my Memory do not much deceive me,) I purposely tryed with care, but without success.

But after all this I must desire, that it may be remembred, that in wording the Proposition of the Imperviousness of Glass, I intimated that I would have it understood of what *Ordinarily* happens. For in some *Extraordinary* cases, which I take to be exceeding rare, I do not absolutely deny,

deny, but that the General rule may admit of Exceptions. And, if it be lawful to conjecture, these exceptions are likeliest to take place, when the peculiar Texture of this or that Glass, is more slight or lax than ordinary; or when the Bodies that are to pervade it, are vehemently agitated by heat; or when, besides a great subtlety, and perhaps degree of Heat too, their particles chance to have a special congruity, to the relaxed Pores of that particular Glass they are to pass through. I remember I have seen, not without some wonder, a sort of Glass of so soft and resoluble a Texture, that Vessels of it of a competent thickness, would be manifestly prejudiced and wrought upon by Liquors, that were not considerably Sharp or Corrosive, if they were put in very hot. I have also heard of another sort of Glasses, made in a certain Forrest, complained of by a Destiller, as subject to be sometimes injured by Corrosive Liquors. I once knew a Doctor of Physick, that by divers credulous Alchymists was sus-

pected to have, what they call the *Philoſophers Stone*, becauſe of a certain Book, Ingenious enough, that he was ſuppoſed to have written on that ſubject. But when after ſome acquaintance I happened to debate his Principles freely with him, he confeſſed to me, that he had been miſtaken, and to invite me to give him my thoughts upon ſuch like works, he frankly made me an ingenuous relation of his Proceedings, wherein the main thing that dazled him, and kept him from ſeeing his Error, was, that he had reduced the matter he wrought on, which was real Gold, to that degree of Fuſibleneſs and ſubtlety, that when he gave too ſtrong a Fire, as miſtake or curioſity made him ſeveral times do, the finer part of the Metal would ſweat through his Glaſſes, and ſtick ſometimes to the outſide of them, and ſometimes to the Neighbouring Bodies. And, when I objected, that he might be miſtaken in this, and that what he thought had come forth by tranſudation, rather iſſued out at ſome

ſmall

ſmall unheeded crack, he replyed that he had made the obſervation ſo often, and with ſuch care, that he was fully ſatisfied it was a real penetration of the Glaſs, by the attenuated Metal, which he was to have convinced me of by Tryal. But, before he could come to make it, by an Errour of his own he unhappily died.

But, whatever be judged of this penetrating Gold, I elſewhere relate, that I having upon a time deſtilled Spirit of Harts-horn with a very ſtrong Fire, into a Receiver that was large and thick enough, but of a courſe kind of Glaſs, it did appear, upon my beſt examination, that the Glaſs itſelf was penetrated by ſome vehemently agitated Fumes, or ſome ſubtile Liquor, that ſetled in ſtrongly ſcented drops on the outſide of the Receiver. But ſuch Inſtances being very rare, and happening but in ſome caſes or conjunctures of circumſtances, that are not like to be at all frequent, they cannot hinder the firſt part of our Propoſition to be true, in

the ſenſe wherein 'tis laid down.

And, as to the ſecond part of the Propoſition, which *aſſerts Glaſs to be pervious to ſome Corporeal ſubſtances*, it may be proved *ad hominem* againſt any Epicurean that ſhould deny it, (and the Carteſians muſt not) by the free ingreſs and egreſs, which our ſeal'd Thermoſcopes ſhew, that the Atoms or Corpuſcles of Cold and Heat are allowed, through the Pores of the Glaſs, that contains the riſing or falling Tincture, or other Liquor. And without proceeding upon the peculiar Principles of the Epicureans, we may give more certain proofs of the Permeableneſs of Glaſs by certain Bodies. For I have elſewhere manifeſtly evinced that the *Effluvia* of a Loadſtone will attract and invigorate Steel, though incloſed in Hermetically ſeal'd Glaſſes; nay, I have alſo ſhewn by Experiment, that the *Effluvia* of ſo groſs and dull a Body as the Earth, are readily tranſmitted through Glaſs, and will operate on Iron, in Veſſels hermetically ſealed. If Light be, as probably 'tis,

'tis, either a ſubtile and rapidly moving Body, or at leaſt require ſuch an one for its Vehicle, it muſt not be denied, that 'tis poſſible for a Body without difficulty to paſs through the Pores of Glaſs; ſince 'tis by its help that we can clearly ſee the Dimenſions, Shapes, and Colours of Bodies included in Glaſſes. To this I ſhall add, that far leſs ſubtile Bodies than thoſe that conſtitute or convey Light, may be made to permeate Glaſs, if their Figures being congruous enough to the Pores of it, their penetration be aſſiſted by an impetuous motion, or a brisk impulſe; as I have found by the increaſe of weight in ſome Metals, expoſed for divers hours in Hermetically ſeal'd Glaſſes, to the action of a Flame. On which occaſion I remember that having ſome years ago tryed the ſame Experiment with ſome Filings of Copper, they had indeed their colour much alter'd, being beautified with exceeding vivid Dyes, which they yet retain, but did not evidently appear to be increaſed in weight, as if, becauſe they

they were not of a Texture loose enough to be melted, the Igneous particles could not pierce them enough to stick fast in them, at least in numbers great enough, to amount to a sensible weight.

But without the help of Fire, or any sensible Heat, I think it not impossible that Glass should be freely penetrated by some kind of Corpuscles, (though I do not yet know of what sort they are) that sometimes happen to roave about in the Air. This you will probably be surprized to read; but perhaps not more than I was at the *Phænomena* that induce me to write it. But because these are very unusual, and can scarce be discoursed of without some odd reflections hinted by them, I thought fit to set down a Circumstantial account of them in another Paper, to which it more directly belongs than to this Essay; and therefore shall now only tell you, what may be sufficient for my present purpose, namely, that having in two or three Vials closely stopt, kept a certain limpid and colourless

leſs Liquor, it would by fits acquire and loſe a high Colour, though I could not reaſonably impute the Changes to any manifeſt ones in the Air, nor to any other cauſe ſo probable, as the Ingreſs and Receſs of ſome very ſubtle and uncommon particles, which at that time happened to ſwim to and fro in the Air, and now and then to invade, and ſometimes to deſert, the Liquor.

There is another ſort of Experiments relating to the Poroſity of Glaſs, to ſhew that it may be pierced into by Bodies that are not corroſive in taſt, and are not Liquors, but only have a forced and temporary Fluidity, if they have ſo much as that.

Theſe Experiments may be drawn from *ſome of the ways* of colouring Panes of Glaſs, for the Windows of Churches and other buildings; I ſay, *ſome of the ways*, becauſe, to deal candidly with you, I think, and ſo I preſume will you ere long, that in divers of thoſe Glaſſes, the Colour doth not pierce at all deep into the Glaſs, but

but is produced by the cloſe adheſion of a deep Red, but thin and tranſparent, Pigment, to the ſurface of a Glaſſy Plate, through both which the Beams of Light paſſing to the Eye, receive in their Paſſage the colour of the Pigment.

But, as by ſome operations the Glaſs is rather Painted, or externally enamelled, than tinged, ſo in ſome others the Pigment or dying ſtuff appears to pierce a little beneath the very *ſuperficies* of the Glaſs, and the Yellow Colour will not only go further or deeper, but ſometimes ſeems (for I do not yet poſitively affirm it) to penetrate the whole Glaſs from ſide to ſide.

The Methods of Painting and ſtaining Glaſs, having been hitherto the Practices of a particular Trade that is gainful enough, and known but to few, the Artificers are wont to be ſhy of communicating their ſecrets, thô we know in general that Glaſs is ſtained, by having the Plates covered with Mineral Pigments, laid on Beds of beaten

beaten Lime, or ſome other convenient Powder, and kept for divers Hours in a ſtrong fire, but yet not ſtrong enough to make the Plates melt down, by which means the Pores of the Glaſs being much opened by the Heat, and the Pigments being likewiſe agitated, and ſome of them as it were vitrified with it, they are made either to pierce into the Plate, or at leaſt to ſtick very cloſely and firmly to it. But becauſe the Practices of GlaſsPainters require, beſides skill and experience, a particular Furnace, and divers Implements, I ſhall add, that to try, whether Glaſs may not, without ſo much ado, be ſo ſtained, as to ſhew it to be Porous, we took prepared Silver, (that Metal having, of all the Minerals I have tryed, the beſt Ingreſs into Glaſs) and having laid it upon a piece of Glaſs, not thick, nor yet ſo thin as to Melt very eaſily, we laid this Glaſs (with the Pigment uppermoſt) warily upon a few Quick-coals, and having ſuffered it to neal a while we gave it about ſuch a degree of heat, as might make

make and keep it red hot, without bringing it to compleat fuſion, and then, ſuffering it to cool by degrees, we found, as we expected, that the Glaſs had acquired a Yellow, and almoſt Golden, Colour, which was not to be waſhed off, or to be taken away, without ſuch ſcraping as would injure or ſpoil the Glaſs it ſelf. The way of preparing Silver for this operation, is not always the ſame, the Glaſs Painters commonly add to the calcined Silver ſome Mineral Bodies, as Antimony, Yellow Oker, or the like. But I, who take the penetration of the colour to proceed from the Silver it ſelf, do ſometimes imploy only ſome thin piece of Silver, ſuch as an old Groat, upon which a little Sulphur being put, and kindled in the open Air, the Metal is preſently calcined, and the Powder made uſe of. And this it ſelf I do not ſo much out of neceſſity, as becauſe the Calcination reduces the Metal into ſmall parts, and gives it a form, that makes it more eaſy be laid on, as one thinks fit. For otherwiſe

otherwiſe, going upon this my ſuppoſition, that the Silver was the true Pigment of the Glaſs, I have more than once made Glaſs Yellow by Leaf-Silver laid flat on the ſurface of it, and a little moiſtened, to keep ſo light a Body from being blown off. And (to note that upon the by) 'tis pretty, that if the Fire be made too ſtrong, which 'tis hard to avoid doing, when we will make it ſtrong enough, without the help of a Furnace, it has ſeveral times happened to me that the dyed Glaſs, though when held againſt the Light it appeared of a Golden or Yellow Colour, yet when held from the Light it appeared Blew, ſo that here we have in a Mineral, ſomewhat that is very like that we admire in the tincture of *Lignum Nephriticum*, which ſhews almoſt the like difference of Colour, as 'tis held againſt or from the Light, which may ſerve for a confirmation of what I have elſewhere ſaid to ſhew that colours may be derived from Mechanical Principles: But that only upon the by. Whether the Gold colour

colour produced by Silver, do favour the hopes of those Alchymists that work on that Metal, upon presumption that 'tis but unripe Gold, 'tis improper here to examine. But since Yellow is not the Colour of Silver, it seems the Yellowness, acquired by our Glass Plates, argues, that there has been some ingress of the substance of the particles of the Silver into the Glass, there appearing no way so ready, to give an account of the change of Colours, as by supposing the Particles of the Silver to be wrought on by the fixt Salts, and other fine parts, of the Glass; since we know, that Metals may afford differing colours, according to the Saline and other Bodies that work upon them, as Copper with Spirit of Urine, which abounds in Volatile Salt, gives a deep Blew; with Spirit of Salt, a fair Green; and with *Aqua fortis*, a Colour that participates of both. And in the making of Glass of Lead with *Minium* and White-Sand, or Crystal, the Glass, it self if well made, is usually of an Amethystine Colour. But

if

if you put a due Proportion, (which is a very ſmall one,) of calcined Copper to it, this Metal will not communicate to the Glaſs its own reddiſhneſs, but be ſo changed by it, as to give it a good green, and ſometimes ſo good an one, that pieces of this Glaſs, ſuch as we have cauſed to be cut and ſet in Rings, might, among thoſe that Judge of Stones but by the Eye, paſs for no bad *Emeraulds*.

On this occaſion, 'tis likely 'twill be asked, whether there be any way of tinging Glaſſes quite through, with a true and beautiful red, and whether the Art of dying Plates of Glaſs, which the windows of many old Churches ſhew to have formerly been practiſed, be now (as 'tis commonly ſuppoſed) altogether loſt?

This Queſtion, conſiſting of 2 Parts, I ſhall quickly diſpatch; the former, by anſwering it without heſitancy in the affirmative. Yet adding withal, that the red tincture being communicated to Glaſs, not properly by mere penetration of the Pigment, but by the incor-

poration of it with Glaſs or its Materials, by the help of fuſion, I think the Experiment of no ſuch great uſe in our preſent Inquiry, as to hinder me from reſerving what I have obſerved about it to a more opportune place. And as to the ſecond Part of the inquiry, it being rather a Hiſtorical than a Philoſophical queſtion, I ſhall not here meddle with it; only I ſhall wiſh the queſtion may be cautiouſly ſtated. For, upon the burning the famous Cathedral of St. *Pauls* Church in *London*, many pieces of the red Glaſs that adorned the windows, were found broken and ſcattered about, ſome of which I procur'd from a Chymiſt, that had carefully preſerved them, deſigning to retrieve the loſt Invention of making the like. But when I came to examine them narrowly, I was confirmed in the ſuſpicion I had, that the redneſs did not penetrate the whole Glaſs, but proceeded from a diaphanous Pigment very artificially laid on, for though in other Poſtures no ſuch thing could be diſcerned, yet when

when I ſo held it, according to my Cuſtom in examining painted Glaſſes, that the ſurfaces of the Plate lay in the ſame level with my Eye, between it and the window, ſo that a broken edge was next my Eye, I could plainly ſee, and made the Chymiſt himſelf ſee, the lower part of the Plate to be of ordinary uncoloured Glaſs, upon which there lay a very thin Plate or Bed of a Diaphanous red Pigment, which, though it were not eaſily, was not impoſſible to be here and there ſcraped off.

But, to return to thoſe colorations that ſeem to pierce into the Pores of Glaſs, I remember that I had once occaſion to deſtil in a ſmall Retort ſome Gold, amalgamed with ſuch a fine and ſubtile Mercury, that being (without the addition of any Salt) put to the Gold in the cold, they preſently grew hot together. And in the deſtillation of this uncommon mixture, I found the matter had, before it flew away, permanently died or ſtained, about an Inch in Diameter of the bottom of the

Glass, with a colour that, looked on from the Light, was like that of the better sort of Turquoises; but beheld when 'twas interposed between the Window and the Eye, appeared of a somewhat Golden colour. And this Glass, with some others oddly colored, I have yet by me to satisfy the Curious, though I cannot but give Advertisement, that the colorations of Glass may be much better performed with such Plates, and in such Furnaces, as the Glass-Painters use, than without them.

Since the Writing of the foregoing Paragraph, I was visited by an industrious person, much addicted to some Chymical Operations, who had formerly advised with me about a Process, of which I had had some Experience, that he conceived might be useful to him. I then acquainted him with some of my thoughts about it, and he having afterwards united Gold with Quick-Silver, (which by its Effects will be easily concluded not to have been common,) he kept them in Digestion

geſtion for ſome Months,& afterwards coming to me with a Melancholy look, told me that the Fire having been once immoderately increaſed in his abſence, the ſealed Glaſs burſt with an affrighting noiſe, and the included Amalgam was ſo ſtrangely diſſipated, that ſcarce the leſt fragment of it could be retrieved. But the Decoction having continued ſo long a time, it ſeems the matter was ſubtiliated enough to have a notable operation upon the Glaſs. For, though the upper part of the Bolt-glaſs were blown of, and ſhattered into many pieces, yet the lower part ſcaped well enough, and when he brought it me, to obſerve what change had been made in it, I took notice with much delight, that the Glaſs ſeemed to be tinged throughout, with ſo fine and glorious a Red colour, that I have ſeen ſeveral Rubies themſelves, in that point, inferiour to it.

FINIS.